



United States Department of the Interior

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Memorandum

July 13, 1998

To: Chief, Division of Consultation and Conservation Planning, Ecological Services,
Region 1, North Pacific Coast Ecoregion, Portland, Oregon
(Attention: Larry Salata)

From: Acting Supervisor, Western Washington Office, Lacey, Washington

Subject: Reinitiation of Intra-Service Biological Opinion on the Addition of the Columbia
River Distinct Population Segment of Bull Trout to Incidental Take Permit
(PRT-808398) for Plum Creek Timber Company (FWS Reference: 1-3-98-FR-0357;
X-Reference: 1-3-96-FW-190) in Accordance with the Unlisted Species Provisions
of the Implementation Agreement for all Vertebrate Species.

This memorandum constitutes the U.S. Fish and Wildlife Service's (Service) reinitiation of a Biological Opinion on amendment of a section 10(a)(1)(B) Incidental Take Permit previously issued to Plum Creek Timber Company, L.P. (Plum Creek), based upon the Habitat Conservation Plan (HCP)(Plum Creek 1996) and Implementation Agreement (IA)(Plum Creek et. al. 1996), in accordance with section 7(a)(2) of the Endangered Species Act of 1973 (16 U.S.C. 1536 et seq.)(Act). This reinitiation of a Biological Opinion addresses the effects of adding the Columbia River distinct population segment of bull trout (*Salvelinus confluentus*) to Permit PRT-808398 and the effects of that permit on the Columbia River distinct population segment of bull trout. The IA between Plum Creek, the Service, and the National Marine Fisheries Service (NMFS) also included unlisted species provisions for all vertebrate species which may be found in the habitats which occur in the HCP Planning Area. At the time of initial permit issuance, it was assumed that consultation would be reinitiated prior to adding any additional species to the Incidental Take Permit. At this time, consultation is being reinitiated regarding the existing HCP and the addition of the Columbia River distinct population segment of bull trout.

The Service has also considered whether or not the proposed action of adding bull trout to the permit is likely to adversely affect the northern spotted owl (*Strix occidentalis caurina*), a Federally listed threatened species; the marbled murrelet (*Brachyramphus marmoratus marmoratus*), a Federally listed threatened species; the grizzly bear (*Ursus arctos* = *U.a. horribilis*), a Federally listed threatened species; the gray wolf (*Canis lupus*), a Federally listed endangered species, the bald eagle (*Haliaeetus leucocephalus*), a Federally listed threatened species; and the peregrine falcon (*Falco peregrinus*), a Federally listed endangered species. The Service believes that the proposed action will not affect any of these species. There are no significant changes in circumstances or actions occurring since the completion of formal consultation and the completion of the June 24, 1996, Biological Opinion (USFWS 1996) with respect to these species.

CONSULTATION HISTORY

Consultation was initiated on February 13, 1996. The initial Biological Opinion was based on information provided in the Multi-Species Habitat Conservation Plan on Forest lands owned by Plum Creek Timber Company, L.P., in the I-90 Corridor of the Central Cascades Mountain Range, Washington (Plum Creek Timber Company 1996), the Final Environmental Impact Statement for the Proposed Issuance of a Permit to Allow Incidental Take of Threatened and Endangered Species: Plum Creek Timber Company, L.P., Lands in the I-90 Corridor, King and Kittitas Counties, Washington (USDI and USDC 1996), the Implementation Agreement for the Plum Creek Timber Company, L.P., Multi-species Habitat Conservation Plan (Plum Creek et al. 1996), 13 technical papers prepared to support the HCP, and various other documents cited in the 1996 Biological Opinion.

The Service also conducted an Unlisted Species Assessment: Analysis of effects on unlisted species from implementation of the Plum Creek I-90 HCP (USFWS 1996b). NMFS completed an analysis of the effects the HCP and IA would have on salmonid species under their jurisdiction (USDC 1996), and that analysis was incorporated by reference into the June 24, 1996, Biological Opinion.

On June 27, 1996, the Service issued an incidental take permit (PRT-808398) to Plum Creek Timber Company, L.P., pursuant to Section 10(a)(1)(B) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1532 et seq.). This permit authorizes the incidental take of the threatened northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus marmoratus*), and grizzly bear (*Ursus arctos*=*U.a. horribilis*); and the endangered gray wolf (*Canis lupus*), in the course of the otherwise legal forest-management and related land-use activities in portions of King and Kittitas Counties, Washington. Pursuant to the Habitat Conservation Plan and the Implementation Agreement, Plum Creek received assurances that then-unlisted vertebrate species would be added to the permit upon listing under the Act, if doing so were consistent with the Implementation Agreement.

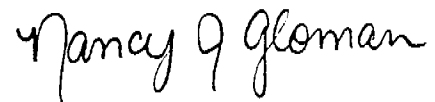
On June 13, 1997, (62 FR 32268) the Service proposed to list the Klamath River population of bull trout as endangered and Columbia River population of bull trout as threatened. The 1996 Implementation Agreement specifies that should any of the plan species that were unlisted at the time of permit issuance subsequently become listed under the Act, Plum Creek may request a permit amendment to have that species added to their permit. On September 11, 1997, Plum Creek requested that bull trout be added to its permit. The Service then began efforts to determine if addition of the Columbia River distinct population segment of bull trout to the permit was warranted. On May 4, 1998 (63 FR 24565), the Service published a notice of proposed amendment. The purpose of that notice was to seek public comment on the Service's proposal to add bull trout to Plum Creek's permit.

Plum Creek's assurances state that, absent extraordinary circumstances (as defined in the Implementation Agreement), plan species would be added to the permit without requiring additional mitigation from Plum Creek. The Service must first determine, however, that such action would not appreciably reduce the likelihood of the survival and recovery of the affected species, or any other species, in the wild and that adding the species to the permit would be consistent with the Service's other responsibilities.

To determine whether adding bull trout to Plum Creek's permit would appreciably reduce the likelihood of the survival and recovery of bull trout or any other species, the Service reinitiated consultation under Section 7 of the Act on May 30, 1998. Comments received as a result of the notice of permit amendment were considered during this process. The Service will also determine whether the permit amendment meets each of the issuance criteria described in Section 10(a)(2)(B). On June 10, 1998, the Fish and Wildlife Service announced the listing of the Columbia River and Klamath distinct population segments as threatened, followed by publication of a final rule (63 FR 31647) with an effective date of July 10, 1998. The Service found that designation of critical habitat for these population segments was not determinable at this time.

This Reinitiation of a Biological Opinion is based upon information contained in the June 24, 1996, Biological Opinion; information accumulated and analyzed during the listing process; and other information cited later in this document and listed in the Literature Cited section.

This reinitiation of a Biological Opinion also incorporates by reference portions of the final documents associated with the original application package, especially HCP sections: 2.10.5.2 Bull Trout; 2.11 Fisheries Limiting Factor Analysis; 2.13 Fish Resources in the Yakama River Subbasin; 2.13.4 Bull Trout; Figure 2.31 Historic And Current Distribution of Bull Trout/Dolly Varden in Washington; Figure 2.32 Bull Trout Range in Planning Area; 3.2.2.1 Lifeform 1; 3.3 Riparian Management Strategy; 3.4.1 Wetlands; 3.5.2.3 Fish; 3.5.3.1 Lifeform 1; 3.6 Mitigation Measures and Measurable Criteria for Determining Biological Success; 5.1 Monitoring; and 5.1.6 Aquatic Resources Monitoring; 5.4 Adaptive Management; and 5.4.3.3 Riparian Management Strategy; especially EIS sections 3.5 Water Quality and Quantity; 3.8 Fish and Fish Habitat; 4.6 Surface Water; 4.9 Fish and Fish Habitat; 4.14.7 Fisheries--Cumulative Impacts; and technical papers produced in support of the HCP which form the foundation for the science and its application including Lundquist et al. (1995) which addressed Bull Trout Range, Occurrence in the Plan Area, Habitat Requirements, Management Considerations, HCP Management Approach, and Habitat Analysis and Potential Effects of the HCP; Watson and Toth (1995) which analyzed limiting factors for salmonids; and Toth et al. (1995) which described Plum Creek's fish conservation strategy. These documents are incorporated here by reference.



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BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Service Action

The Service proposes to add the Columbia River Basin distinct population segment of bull trout to Permit PRT-808398. Plum Creek was issued a permit authorizing incidental take of the northern spotted owl (owl), marbled murrelet (murrelet), grizzly bear (bear), and the gray wolf (wolf) under Section 10(a)(1)(B) of the Act on June 27, 1996. At that time, the Services signed an Implementation Agreement (IA) with provisions to conserve currently unlisted fish and wildlife species which may be associated with habitats on their properties in the HCP Planning Area. The IA provided that, should any of these species be listed in the future, Plum Creek may request that they be added to the permit. At that time, the Service would reinitiate consultation pursuant to Section 7 of the Act and make a determination that the species may be added, that additional mitigation is required from Plum Creek before such species may be added due to extraordinary circumstances, or that the species cannot be added because to do so would appreciably reduce the likelihood of survival and recovery of the species in the wild. Plum Creek committed to manage its lands within the HCP Planning Area pursuant to the HCP and IA that were developed as part of their permit application. The term of the HCP and permit are 50-100 years. Some aspects of the HCP and IA may terminate at year 50 (Phase I) while others (Phase II) may continue for an additional 50 years. The HCP and IA allow for the possibility of early termination of the permitted activity by the applicant subject to the permit condition requiring that any past incidental take of listed species has been sufficiently mitigated prior to termination. Other provisions for revocation by the Services or amendment are included in the IA, including a provision for termination of the HCP with respect to any unlisted species for a material violation of the HCP with respect to that species.

Covered Area Location and Description

Location

Plum Creek's ownership within the HCP Planning Area is located both east and west of the Cascade Mountain crest along the Interstate-90 (I-90) corridor in central Washington, between 60 to 100 miles east of Seattle. In selecting the geographical boundaries for implementation of the HCP (HCP Figure 1), Plum Creek considered the then proposed Growth Management Act zoning in King and Kittitas Counties, the potential habitat of the species to be protected, and the anticipated future activities that might result in incidental take of the above mentioned species. Plum Creek's timberlands in the HCP Planning Area incorporate portions of 11 Townships on the western slopes of the Cascade range, and 19 Townships on the eastern slopes of the Cascade range (HCP Appendix 1).

Definition

For purposes of consultation under Section 7 of the Act, the "Action Area" is defined at 50 CFR 402 to mean "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." Although the actions which might potentially cause impacts to listed and other covered species are restricted to the area owned by Plum Creek and covered by the Permit (termed the Project Area in the IA and the HCP area in the HCP), the effects of the action on these species may extend beyond this area. For purposes of this consultation on the Columbia River distinct population segment, the Service has defined the Action Area to include those portions of the original HCP Project Area which lay east of the Cascade Crest; and the adjacent and interspersed Federal, State, and private lands described as the HCP Planning Area in the HCP and EIS that also lie east of the Cascade Crest.

Ownerships and Designations

The subject ownership occurs in a "checkerboard" pattern in an area commonly referred to as the Interstate-90 (I-90) Corridor. The term "checkerboard" refers to alternate sections of public and private land. The outer boundaries of the HCP "Planning" or "Analysis" Area encompass 418,690 acres; but, because of the checkerboard configuration of land ownership, the area includes 249,513 acres of other ownership. Approximately 71 percent of the HCP Planning Area is east of the Cascade Crest and comprises the lands being analyzed in this Biological Opinion (Action Area). Plum Creek's ownership in the HCP Planning Area is generally intermingled with Federal lands, and consists of 169,177 acres of alternating sections (1 square mile) of Plum Creek lands bordered, mainly, by Federal lands administered by the U.S. Forest Service. Plum Creek's ownership covered by the permit on the east side of the Cascade Crest is approximately 117,473 acres.

The land-designations for the Federal lands are presented in Figure 10 and Table 4 of the HCP. Within the Action Area, about 49 percent of the Federal land is designated as Adaptive Management Areas (AMA), 31 percent as Late-successional Reserve (LSR), and the majority of the remaining Federal lands are Matrix. The total area on the east side of the Cascade Crest within the HCP boundary encompasses 298,774 acres, with the following ownerships:

• U.S. Forest Service	159,290 acres
• Plum Creek	117,473 acres
• Other (State and private)	16,068 acres
• Water (i.e., lakes, streams)	5,943 acres

Table 1 presents the acreage by ownership within each of the designated Northwest Forest Plan areas.

Table 1. Acres of land ownership in each of the designated areas and matrix under the Northwest Forest Plan within the Action Area.

Designated Area and Matrix	USFS	%	Plum Creek	%	Other	%	Water	%	TOTAL
Congressionally Reserved Area	7,943	5.0	17	0.0		0.0		0.0	7,960
Late Successional Reserve	49,063	30.8	36,597	31.2	1,057	6.6		0.0	86,717
Adaptive Management Area	77,485	48.6	55,463	47.2	7,557	47.0	5,943	100	146,449
Managed Late Successional Reserve	45	0.0	0	0.0	0	0.0	0	0.0	45
Administratively Withdrawn Area	1,934	1.2	12	0.0	57	0.4		0.0	2,003
Matrix	22,820	14.3	13,158	11.2	78	0.5		0.0	36,056
Not designated	0	0.0	12,226	10.4	7,319	45.5		0.0	19,545
TOTALS:	159,290	100	117,473	100	16,068	100	5,943	100	298,774
Percent of Total HCP Area		53.3		39.3		5.4		2.0	298,774

NOTE: USFS - U.S. Forest Service

The predominant nonfederal land use in the I-90 corridor and surrounding areas is commercial timber production. Federal lands are managed for multiple uses, but timber harvest has traditionally been one of the most significant land uses that has affected wildlife habitat.

Natural Setting

The action area characteristics (such as climate and dominant vegetation) were described in the HCP, the 1996 Biological Opinion, and USFWS (1998a).

Subbasin Characteristics

Two major subbasins are located within the HCP Planning Area. The Yakima River and its tributaries drain the East Side and the Green River drains most of the West Side.

The Green River in the HCP Planning Area is upstream of the Howard Hansen Dam, and Plum Creek's ownership in this area is interspersed amongst the Tacoma Municipal Watershed. Currently, no natural spawning by anadromous fish occurs upstream of the diversion dam. Other smaller west-side drainages in the HCP Planning Area are isolated from anadromous fish by waterfalls. Bull trout are apparently absent from the Upper Green River. The Green River is outside the Action Area because it drains to the west into Puget Sound.

The Action Area is within the Yakima River Subbasin. The status of resident and anadromous fish in the Action Area is addressed in the HCP and summarized below. East of the Cascade crest, the Action Area drains into the Yakima River Subbasin. Mainstem and most tributary streams in this Subbasin were historically accessible to anadromous fish. Both resident and anadromous species are present in the Yakima Subbasin.

The Yakima River Subbasin encompasses 6,155 square miles and contains approximately 1,900 river miles of perennial streams. Predominant land use within the Yakima Subbasin includes irrigated agriculture (1,000 square miles), urbanization (50 square miles), timber harvesting (2,200 square miles), and grazing (2,900 square miles). Riparian corridors range from severely damaged to nearly pristine. Exceptional riparian corridors are generally located along forested, headwater reaches in the upper portion of the subbasin, whereas degraded riparian habitat is concentrated in the valleys in the lower portion of the subbasin, in areas frequently associated with agricultural operations (YIN et al. 1990).

The Yakima originates near the crest of the Cascade range above Keechelus Lake at an elevation of 6,900 feet and flows southeastward for 214 miles to its confluence with the Columbia River at river mile (RM) 335.2. Thus, dams have played a fundamental role in shaping the health of the remaining fish stocks. Major tributaries to the Yakima include Kachess, Cle Elum, and Teanaway Rivers in the northern portion of the subbasin, and the Naches River in the west. The Naches River has four major tributaries including the Bumping, American, Tieton, and Little Naches Rivers. Ahtanum, Toppenish, and Satus Creeks enter the Yakima River in the lower portion of the subbasin.

The Yakima Subbasin contains six major reservoirs. The Yakima River flows out of Keechelus Lake (157,800 acre feet), the Kachess River flows from Kachess Lake (239,000 acre feet), the Cle Elum River flows from Cle Elum Lake (436,900 acre feet), the Tieton River flows from Rimrock Lake (198,000 acre feet), and the Bumping River flows from Bumping Lake (33,700 acre feet). The North Fork of the Tieton River connects Clear Lake (5,300 acre feet) with Rimrock Lake. All reservoirs except Rimrock and Clear Lakes were natural lakes prior to impoundment (YIN et al. 1990).

The mainstem of the Yakima River contains six major diversion dams, and several smaller dams are located along the Naches River. The dams on the Yakima River include Easton (RM 203), Roza (RM 128), Wapato (RM 107), Sunnyside (RM 104), Prosser (RM 47), and Horn Rapids (RM 18). The primary dams on the Naches River include Wapatox (RM 17) and Naches Cowiche (RM 4).

Riparian ecosystems extend across ownerships, especially in the HCP Planning Area with its checkerboard pattern of jurisdictional and ownership boundaries. Riparian and wetland buffers occupy over 61,000 acres within the HCP Planning Area. There are 12,000 acres of such buffer areas on Plum Creek's property in the HCP Planning Area, of this, 10,900 acres are riparian buffers and 1,100 acres are wetland buffers. Approximately 7,100 acres of Plum Creek's HCP riparian buffers, called Riparian Habitat Areas (RHAs), occur within the Action Area.

Withdrawal of water from the Yakima River and restriction of inflow during reservoir filling are the most significant factors limiting fish production in the Yakima Subbasin (YIN et al. 1990). Water supplies are severely overtaxed by the demands of irrigation that compete with flows needed for fish production. Except for a minimum flow below Prosser dam and a court-ordered minimum flow maintained for egg incubation in the Yakima from Easton dam to the Teanaway River, there are no binding minimum instream flows for fish (YIN et al. 1990). Consequently, instream flows are rarely optimal anywhere in the subbasin, including the streams and tributaries in the Action Area, and may be critically low for fish production in drought years. In an average year, the total available water supply in the subbasin is barely adequate for irrigation and never adequate for maximum fish production (YIN et al. 1990).

The effect of water diversions and water withdrawal in tributary streams is more severe than in the mainstem of the Yakima River, because the diversions frequently lack effective fish passage and protective devices, and because proportionately more water is diverted. Water diversions in tributary streams can affect the entire life cycle of salmonids, from egg to returning adults. The effects are more significant on fish that spend an appreciably greater proportion of their life cycle as juveniles in the smaller tributary streams.

Stream Types/Characteristics:

There are a total of 1,424 miles of streams on Plum Creek's lands in the HCP Planning Area (HCP Table 27). Approximately 800 miles (56 percent of the total stream miles) occur within the AMA, 348 miles (24 percent) occur within the LSR, and 276 miles (20 percent) occur in the Matrix.

Based on WDNR's stream classification system, there are 433 miles of fish-bearing streams (Types 1 and 3 streams) within the Planning Area (18 percent of all streams within the Planning Area. Of this total, 129 miles (30 percent of 433) are located on Plum Creek ownership. Within the Action Area there are at least 349 miles of fishbearing streams (WDNR Type 1-3), 18 percent of the WDNR identified streams within this area (Table 2).

There are approximately 215 miles of perennial, nonfish-bearing streams on Plum Creek's lands in the HCP Planning Area. However, more than 1,000 miles of streams on Plum Creek's lands are ephemeral streams or unclassified streams of unknown status. Within the Action Area, about 88 miles of streams are fishbearing, 120 miles are perennial but without fish, and another 709 miles are seasonal, intermittent, or unclassified (Table 3).

Table 2. Stream miles by WDNR stream Type and Percent gradient within the Action Area (Yakima River Basin).

Type\Gradient	0-4%	5-10%	>10%	Total
Type 1-3	129.5	88.7	131.1	349.3
Type 4	14.7	38.9	215.9	269.5
Type 5	9.4	40.0	822.4	871.8
Type 9	22.4	28.9	441.2	492.5
Total	176.0	196.5	1,610.6	1,983.1

Note: Stream gradient was derived using U.S. Geological Survey Digital Elevation Models imported as lattice into ArcInfo. Gradient is expressed as percent from "rise" over "run" (i.e., a 45 degree angle is 100 percent gradient). Stream miles are based on WDNR ArcInfo stream coverages "clipped" at Plum Creek's HCP boundary. WDNR Stream Type 1-3 - Fish Bearing; WDNR Stream Type 4, 5, and 9 = Nonfish Bearing. SOURCE: PCTC HCP GIS Analysis. Hydrology from WDNR GIS layer.

Fish Resources - The two extant anadromous salmonid species are the chinook salmon (*Onorhynchus tshawytscha*) and summer steelhead (*O. mykiss*). Native coho salmon (*O. kisutch*) have been extinct from the Yakima River since 1984 (Watson and Toth 1995; YIN et al. 1990).

Bull Trout - Adfluvial populations of bull trout exist in portions of the Yakima River basin within the Action Area in Keechelus Lake/Gold Creek, Kachess Lake/Box Canyon Creek (and possibly Mineral Creek), and Cle Elum Lake - Waptus Lake/Waptus River (HCP Figure 32). Fluvial populations also exist in the mainstem Yakima River. It is assumed that bull trout were historically distributed throughout the Planning Area in the mainstem Yakima River and all accessible larger tributary streams. The current distribution of bull trout suggests that the assumed historic population has been severely fragmented (Mongillo 1993), or that the assumption is wrong regarding the historic

Table 3. Approximate miles and percentages of stream types (Washington State Department of Natural Resources Stream-Typing System) within each riparian protection strategy by ownership within the Action Area.

Stream Type	U.S. Forest Service				Plum Creek Timber Company L.P.					Other Private			
	300' RCA	150' RCA	Sub-Total		200' RHA	100' RHA	25' RLTA	No Buffer	Sub-Total	Std RMZ	No Buffer	Sub-Total	Total
1	5 (13%)		5		23 (57%)				23	12 (30%)		12	41
2	61 (79%)		61		13 (17%)				13	3 (4%)		3	77
3	82 (57%)		82		51 (36%)				51	10 (7%)		10	143
4		150 (52%)	150			120 (42%)			120		18 (6%)	18	288
5		551 (52%)	551					477 (45%)	477		38 (4%)	38	1,067
9 ^a		258 (48%)	258					232 (43%)	232		45 (8%)	45	534
Total	149	959	1,108		88	120		708	916	25	101	126	2,150

^a - Type 9 streams are currently unclassified or of unknown status; however, the vast majority of Type 9 streams would likely be classified as Type 5 streams.

Std - Standard

RCA - Riparian Conservation Area

RHA - Riparian Habitat Area

RMZ - Riparian Management Zone

RLTA - Riparian Leave Tree Area

distribution. No long-term population trend data is available. Bull trout are able to inhabit higher-gradient streams than coho or chinook salmon and can occupy streams with gradients greater than 20 percent (Watson and Hillman 1997).

A description of other features of the area such as vegetative types, land form, slope, aspect, and parent material is presented in Jensen (1995). Current distribution of habitats and future projections are presented in Figures 46-48 and Tables 30 and 30b of the HCP. Habitat categories for forested lands are defined and described in HCP Section 2.3.

Covered Activities

The incidental take permit only authorizes incidental take in connection with those aspects of commercial forest management considered in the HCP. These activities include timber harvest (cutting, felling, experimental silviculture, limbing, yarding and yarding corridors, construction and use of landings, loading and hauling); road construction, maintenance, decommissioning, and administrative and commercial road use; road access; site preparation including slash and residual treatment; firewood cutting; planting; fertilizing; pest and brush control; fire and erosion control; thinning and pruning; administration and monitoring; surveying, conducting stand examinations and inventory, and cruising timber; painting or marking of timber or stand boundaries; entry by silviculturalists, wildlife biologists, foresters, management, enforcement, and other personnel for miscellaneous activities such as assessments, land surveys, and general reconnaissance; and all other activities related to the conduct of the timber-management program and required actions of the HCP (e.g., research). Also included are administration and commercial use of gravel pits and rock quarries necessary for forest management; and administration and maintenance of all existing buildings, radio towers, and associated telecommunication facilities; and ecosystem-based forest planning on 169,177 acres of its ownership in the I-90 corridor of the central Cascades Mountain Range in Washington.

Summary of HCP Actions

The HCP includes commitments to provide certain amounts and types of habitats and stand structural classes. Timber harvest and road construction must be consistent with maintaining those habitat levels. In general, the HCP does not make silvicultural prescriptions outside of some minimal leave-tree requirements and a few situation-specific standards and guidelines pertaining to special habitats, such as strict limitations to activities within the riparian zones. It is a programmatic-style plan. No predictions of the number of acres to be treated per decade are made in the HCP because the HCP does not limit the amount of timber harvest in uplands so long as the required conditions are met.

Individual management units are not scheduled for harvest at any particular time and individual road locations and management are not specified. The HCP focuses on timber management as the primary landscape-influencing factor and the factor with the most influence on listed wildlife species. As long as Plum Creek's activities are consistent with the HCP, the permit provides a mechanism to authorize incidental take of listed species under Section 10 of the Act. In addition, under the HCP, Plum Creek is required to comply with State forest practices rules and regulations throughout the Permit Period.

While WAC 222-16-080-7(a) exempts activities covered under an HCP from the provisions of WAC 222-16-080, State rules and regulations such as road-construction standards and minimal leave-tree requirements are not intended to be supplanted as a result of implementation of the HCP. These are the major actions which occur under the HCP. Other actions, such as road-building for access, are conducted in support of timber harvest and management.

Silvicultural Methods - By definition, even-aged harvest methods include clearcuts, seed-tree harvests (in which 20 or fewer trees per acre remain after harvest), and overstory removal (where more than 5,000 board feet per acre are removed and fewer than 50 trees per acre at least 10-feet in height remain after harvest). Shelterwood regeneration harvest is also considered by the State of Washington to be an even-aged harvest method when 20 or fewer dominant, vigorous trees per acre remain after harvest. However, Plum Creek's policy when using the shelterwood method is to leave more than 20 trees per acre. As such, the shelterwood method used by Plum Creek is considered, under State definition, an uneven-aged harvest method.

Plum Creek uses even-aged and uneven-aged harvesting techniques in its ownership in the Cascade range. In 1994, Plum Creek used even-aged harvesting techniques in approximately 17 percent of its harvest operations east of the Cascades crest, and in about 65 percent of its operations west of the Cascades crest.

Even-aged harvesting, particularly clearcutting, is a widely used form of timber harvesting on the west side of the Cascades. These harvesting techniques favor tree species, such as Douglas-fir, which grow best in open conditions with full sunlight. On the east side of the Cascades, where arid conditions prevail and stand structure and species composition are more varied, uneven-aged techniques, such as shelterwood, overstory removal, and selective harvesting, are more common. Even-aged harvesting is also conducted on the east side where appropriate.

Shelterwood harvesting and other uneven-aged techniques favor shade-tolerant trees such as western hemlock. Under standard silvicultural practices, shelterwood prescriptions are usually followed by a shelterwood-removal harvest (subsequent removal of shelterwood trees), 10 to 20 years following harvest and successful regeneration. However, because of Plum Creek's commitment to its Environmental Principles, trees are left on site until the next harvest rotation.

Overstory removal involves harvesting trees that comprise the upper canopy layer to encourage rapid growth of trees in the understory, creating an even-aged stand. By selectively removing or leaving large, scattered, mature trees, overstory removal can be used as an effective uneven-aged harvesting method to maintain diverse wildlife habitat. Overstory removal is most effective in stands with distinct canopy layers or size classes.

Plum Creek conducts variations on the standard silvicultural methods where necessary for site-specific objectives, such as to maintain structural diversity. To achieve this objective, Plum Creek leaves not only dominant, vigorous trees, but also leave trees with a variety of species, diameters, and vigor classes (i.e., dead and dying trees) to maximize structural diversity. Except where noted, trees counted by Plum Creek as remaining after harvest are those trees at least 10 inches in diameter at

breast height (dbh) and have at least the top one-third of the stem supporting green, live crowns.

Plum Creek leaves representative trees, either individually or in clumps within the harvest units (outside of riparian buffers), to provide habitat diversity for wildlife. As mentioned earlier, unlike seed-tree or shelterwood harvesting techniques done elsewhere, trees are left on-site until the next harvest rotation. Regeneration is accomplished primarily through planting.

Harvesting Methods - Plum Creek expects their foresters to protect and enhance environmental values of the forests while providing economic timber growth and harvest. Timber falling contractors are required to: (1) avoid yarding downed logs through streams; (2) refrain from causing soil erosion or degradation of side slopes; (3) mitigate impacts to natural resources; (4) comply with special conditions (i.e., trail protection or visual sensitivity); and (5) maintain a cost-effective production level while meeting State and Federal safety guidelines. In addition, Plum Creek ensures that riparian buffers are maintained along some smaller, nonfish-bearing streams which normally do not require protection under State law. Trees are also left standing in designated Upland Management Areas (UMAs), as wildlife reserves and green recruitment trees, and for visual buffers, green-up strips, and wildlife corridors.

Current State Forest Practices Rules and Regulations adopted in 1992 stipulate that, as a minimum in eastern Washington, two wildlife reserve trees (i.e., defective, dead, damaged, or dying trees which provide or have the potential to provide habitat for wildlife species dependent upon standing trees), two green recruitment trees (trees left to become future wildlife reserve trees), and two downed logs shall be retained for each acre harvested. Plum Creek exceeds these standards.

Stand Maintenance - Stand maintenance or vegetation management is essential in seedling establishment and involves the control of undesirable vegetative competitors. Vegetative competition for light is a major contributor to seedling mortality and growth in western Washington, whereas strong competition for moisture is a major cause of seedling mortality in eastern Washington.

Plum Creek uses traditional means of treatment including aerial and ground application of herbicides or mechanical cutting techniques to control competing vegetation. Newly established trees are inspected for several years following planting to ensure that the growth of trees is not impeded by vegetative competitors. However, the Company minimizes its use of herbicides, and spraying is prohibited in riparian areas. During the period 1990 through 1994, herbicides were applied to less than 700 acres annually, less than one percent of the total 169,177 acres of Plum Creek's land within the HCP Planning Area. The use of herbicides in site preparation and in stand release within the HCP Planning Area remains low because:

1. High utilization of harvested material supports rapid reforestation prior to the establishment of potential competing vegetation;
2. Use of high-quality seedlings and seedling handling and planting techniques for reforestation ensure high survival and rapid establishment of seedlings;
3. More uneven-aged and partial harvests are conducted which do not require as much

- site preparation and replanting following harvesting, thereby reducing the need to use herbicides or other measures to control vegetative competitors;
4. Use of uneven-aged and partial harvests (common east of the Cascade Crest) increase costs and reduce the effectiveness of spraying herbicides as a result of the snags and large, standing timber's potential to interfere with aerial application;
 5. Plum Creek exceeds State forest practice rules and regulations by prohibiting spraying in riparian areas, and by not allowing spraying within 100 feet of water bodies;
 6. Herbicides are used primarily on highly productive sites, at lower elevations. Because of decreased vegetative competition at higher elevations, herbicide use is minimal; and
 7. All herbicides used are registered for forest use by the Environmental Protection Agency; and
 8. Forestry use of target-specific herbicides are replacing broad spectrum herbicides, as an example, one commonly used herbicide in upland stands is even registered for use in aquatic environments.

The Washington State Forest Practices Board has adopted regulations intended to ensure that the handling, storage, and application of forest pesticides and herbicides does not endanger public health or jeopardize water quality standards. Requirements of these regulations include:

1. A 50-foot buffer along all fish-bearing streams (Type 1-3 streams) and flowing nonfish-bearing streams (Type 4 and 5 streams);
2. No aerial application of pesticides or herbicides within Riparian Management Zones (RMZs);
3. Parallel flight paths and use of drift control agents adjacent to stream buffers;
4. Reconnaissance over-flight by pilots and landowner of target area prior to application;
5. Shut-off of chemical spray during turns and over open water;
6. Aerial pesticide application area shall be posted by the landowner; and
7. At least a 200-foot buffer strip around residences and a 100-foot buffer strip adjacent to agricultural lands is retained.

Road Building and Maintenance - All roads constructed by Plum Creek are located to minimize impact to the landscape and to facilitate forest-management activities. Almost all roads are designed as single lane, with occasional turnouts. Typical road-construction techniques include installation of a 15-foot subgrade with a 2-foot drainage ditch. Nearly all roads are underlain with small-diameter rocks to enhance all-weather use. The typical running (driving) surface width for roads is 12 feet. Roadway grades are typically less than 15 percent with occasional variances determined on a site-by-site basis.

HCP Mitigation Measures

"Mitigation measures" include actions taken by Plum Creek to avoid, minimize, and mitigate impacts to species addressed in the HCP. These actions include management actions as well as actions to monitor and address impacts during implementation of the HCP. Mitigation in a multi-species, habitat-based plan is inextricably woven into the HCP itself. The following constitute some basic elements of the HCP. A majority of these actions contribute directly to the biological success of the HCP and are quantifiable. They also may constitute the measurable criteria that Plum Creek uses to monitor and evaluate the biological success of the HCP. The Service only considered the mandatory elements in its evaluation of mitigation and resulting impacts. Some actions were completed prior to implementation. Measures contained in the HCP to monitor and mitigate for impacts to listed species, as well as unlisted species, are described in the 1996 Biological Opinion, pages 4 through 11.

Mitigation Relative to Bull Trout

One of the primary goals of the HCP is to develop and retain healthy riparian and aquatic systems. This includes increasing instream and riparian habitat quality so as to develop properly functioning fish habitat capable of supporting both resident and anadromous fish species. The actions taken under this HCP are intended to result in fish habitat conditions that allow for increases in salmonid population numbers. The HCP was specifically designed to protect instream fish habitat and maintain healthy riparian habitats, and utilizes a combination of conservation measures expected to protect bull trout.

The Riparian Management Strategy includes the maintenance and protection of riparian habitat areas (RHAs). RHAs are important for both watershed and wildlife habitat protection. RHAs and wetlands total more than 12,000 acres on Plum Creek's lands in the HCP Planning Area, and about 7,101 acres are in Plum Creek's RHAs east of the Cascade Crest. HCP mitigation is different east of the Crest (where bull trout occur within the HCP Planning Area) than the mitigation west of the Crest. Some of these measures are the result of direct attention to the salmonid resources and others are a result of indirect protection from measures applied to other resources. For instance, riparian buffers on small streams are more robust on east-side streams because wild salmonids inhabit the Action Area and road densities will be less in the areas known to contain bull trout, due to measures put in place to conserve grizzly bears. Open-road densities are addressed by reducing road densities as a specific measure, but also because the requirement to retain visual screening along open roads serves as incentive for further road closures to avoid a need to leave additional valuable timber standing in harvest units. The use of herbicides east of the Crest is expected to be even lower than west of the Crest because uneven-aged management reduces the need for replanting with understory control, and the residual trees reduce the effectiveness and increase the cost of herbicide application. Fewer of the smaller streams are exposed to edge effects along buffers as a greater percentage of the harvesting does not involve a drastic regeneration harvest. The following section focuses on the mitigation steps that are most relevant to bull trout.

The first component of the HCP's riparian strategy is to establish interim and minimum standards. These standards are either maintained or increased by watershed analysis. If watershed analysis indicates that additional conservation measures are appropriate, then they will be implemented. The same is true if the aquatic monitoring program indicates that additional measures are necessary. Under the HCP, for non fish-bearing streams that have the attributes that would be expected in a fishbearing stream, presence or absence of fish (not just bull trout) is verified prior to harvest. See Toth (1995) and Toth et al. (1995) for elaborations on the HCP riparian strategy and the relationship between the HCP and Watershed Analysis.

Interim and Minimum Guidelines for Riparian Habitat Areas - Plum Creek established prescriptions for RHAs along streams that support a wide array of wildlife species including bull trout and anadromous fish. Plum Creek is implementing the following interim (i.e., these guidelines are considered interim until completion of watershed analysis) and minimum guidelines in RHAs:

1. Fish-bearing streams - Establish 200-foot RHAs (measured as horizontal distance from the edge of the stream) on each side of all fish-bearing streams. In terms of stream systems in the HCP Planning Area, Plum Creek's major consideration is whether a particular stream is fish-bearing or nonfish-bearing, and perennial or intermittent).

Two hundred-foot RHAs will provide at least one tree height of protection for fish-bearing streams because the average tree height for late-seral riparian vegetation within the Action Area typically ranges between 80 and 140 feet for east-side conditions.

The entire RHA is retained as spotted owl habitat, or if not currently functioning as spotted owl habitat, the area is managed to provide forest conditions equal to or greater than FD habitat for spotted owls (see HCP Section 2.4). A 30-foot (horizontal distance), "no-harvest" area is situated in RHAs adjacent to fish-bearing streams to maintain bank integrity, provide nutrients, and contribute large woody debris to the stream. (No-harvest means, no commercial harvest of conifer trees; limited silvicultural prescriptions for conifers and harvest of deciduous trees are allowed to address watershed and wildlife concerns [e.g., excessively high tree density or undesirable coarse woody debris species]). Beyond the 30-foot, no-harvest zone, management objectives are to meet large woody debris goals, maintain a late-successional forest structure, accommodate channel migration, slope stability, and/or additional wildlife considerations, and to implement a "feathering treatment" whereby more "large trees" are left at the inner portion (i.e., the area closest to the stream) of the RHA. Structural features within RHAs are tracked to determine the extent and distribution of structural stand stages. One-time (i.e., one harvest during the Permit period) selective or partial harvests are allowed in RHAs, if Plum Creek can ensure that post-harvest conditions in the RHAs will provide, at a minimum, the equivalent of spotted owl habitat (i.e., FD habitat or greater). These harvests incorporate removal of no more than 50 percent of the merchantable (commercial) timber volume

available for harvest in the 200-foot RHA. The management of these buffers is dictated by post-harvest criteria as well as by stand-level amounts of various forest stages. For instance, over the 50-year duration Habitat Conservation Plan, these areas are scheduled to improve from 37 percent mature forest or better to 60 percent mature forest or better. Any riparian habitat area entered for selective harvest must retain minimum standards designed to maintain riparian functions (on the east side of the Cascade Crest, a quadratic mean diameter of 9 inches and a Relative Density (Curtis 1982) of 33 must be retained).

2. East-side Nonfish-bearing, perennial streams - Along perennial streams (includes spatially intermittent streams containing perennial subsurface flow) upstream of bull trout streams (and virtually every other non fish-bearing perennial stream east of the Cascade Crest), Plum Creek provides 100-foot RHAs on each side of these streams. Harvest-exclusion zones are not maintained on nonfish-bearing streams, but a 30-foot equipment exclusion zone is established. The primary purpose of the RHAs along nonfish-bearing streams is to protect downstream fish habitat, water quality, and habitat for other aquatic and riparian-dependent wildlife species, such as frogs and salamanders (i.e., Lifeform 2). These RHAs are also managed to maintain NRF or FD habitat through harvest deferral or partial harvesting.
3. Seasonal/Ephemeral Streams - Plum Creek's HCP leave-tree strategy precludes counting trees already left within Riparian Habitat Areas. Because of this fact, logistics, and their Environmental Principles, Plum Creek clusters some leave trees in areas adjacent to many smaller streams, which otherwise would receive no specific protection under State Forest Practices Rules and Regulations. Nonfish-bearing streams that may be susceptible to landslides or debris flows (e.g., inner gorge topography), are protected by deferring timber harvest within those areas until, and after, completion of watershed analysis. Appropriate-sized riparian buffers are also determined through watershed analysis. Seasonal streams found to be fish-bearing will receive fishbearing buffers and receive special consideration under watershed analysis.
4. Yarding Corridors - Yarding corridors may be necessary in RHAs to accommodate full-suspension or, if necessary, partial suspension cable yarding systems. All yarding corridors are placed at the discretion of Plum Creek. Plum Creek minimizes the removal of trees from corridors. During yarding operations, normal breakage of trees may occur and provides snags and downed material which provide habitat for many wildlife species. In addition, the post-harvest yarding corridors will be comprised of young forest and residual trees which provide multi-structural forests and habitats and enhance wildlife diversity in the RHAs. As an overall objective, Plum Creek attempts to disturb no more than 15 percent of the stream corridor in or adjacent to each harvest unit. If site-specific conditions or safety considerations require larger yarding corridors, Plum Creek can, at its discretion, expand the yarding corridors, but disturbs no more than 20 percent of the stream corridor in or adjacent to any harvest unit.

Plum Creek also avoids, where possible, placing yarding corridors across fish-bearing streams. Plum Creek attempts to minimize the necessity of yarding corridors. However, in some areas, yarding corridors are preferable if the only alternative is construction of additional roads or landing areas.

Wetlands

Riparian zones are defined in Brown (1985) as terrestrial areas where the vegetation and microclimate are influenced by perennial and/or intermittent water, associated high water tables and soil which exhibit some wetness characteristics. This habitat is transitional between true "bottomland" wetlands, and upland terrestrial habitats. Riparian areas may or may not qualify as wetlands depending upon soil characteristics, hydrology, and predominant vegetation. The definition of wetland ecosystems used in the HCP is "areas that have a predominance of hydric soils and are inundated or saturated by surface or by ground water, and under normal circumstances do support a prevalence of hydrophytic vegetation typically adapted for life in saturated conditions." Marshes, bogs, seeps, wet meadows, and shallow ponds are examples of wetlands found within the HCP Planning Area.

The riparian wetlands will be identified during watershed analysis and appropriate prescriptions to protect the functions and values of these wetlands will be developed. Most of the wetlands within the HCP Planning Area are spatially and functionally associated with rivers and streams. Other wetlands may occur more or less in isolation. These isolated wetlands are generally small, but may have unique characteristics and provide habitat for numerous wildlife species. Plum Creek implements, as minimum and interim guidelines, the Riparian Management Strategy and standard State Forest Practices Rules and Regulations to protect all wetlands.

The Forest Practices Rules and Regulations recognize two major categories of wetlands, forested or nonforested. The nonforested wetlands are divided further into two classes: Type A (i.e., generally larger than 0.5 acres, with open water), and Type B (i.e., other nonforested wetlands).

The Forest Practices Rules and Regulations require buffers, termed wetland management zones (WMZs), on all Type A wetlands and on most Type B wetlands. Under the HCP, for Type A and B wetlands greater than 5 acres in size, Plum Creek retains an average WMZ width of 200 feet (100-foot minimum) because of the greater seasonal persistence of open water, seasonal and spatial variation, and year-to-year variation. This greatly exceeds the buffers required by State regulations. For Type A wetlands between 0.5 and 5 acres, Plum Creek retains a 50-foot average WMZ. For Type B wetlands between 0.5 and 5 acres the WMZ retained is a minimum of 25 feet.

In addition to leaving WMZs, there are several other harvest restrictions around nonforested wetlands required by the State Forest Practices Rules and Regulations. For example, individual trees and small (i.e., less than 0.5 acres) patches of forested wetlands cannot be harvested if surrounded by a Type A or Type B wetland, although these trees can contribute to the leave-tree requirement in the WMZ. Harvest of upland areas or larger forested wetlands, if they are surrounded by Type A or Type B wetlands, require a plan approved by the Washington Department of Natural Resources (WDNR). Timber cannot be felled into or cable yarded across a Type A or Type B wetland without prior

approval by WDNR. In addition, tractors or wheeled skidders cannot be used in Type A or Type B wetlands without prior approval of WDNR. Slash disposal is not allowed in Type A or Type B wetlands or in WMZs, scarification is not allowed in any wetland, and machine piling is discouraged. These provisions were adopted by the HCP.

Although, under State regulations, forested wetlands have fewer restrictions on timber harvest than nonforested wetlands, they have special rules designed to protect wetland soils. Cable systems are allowed in forested wetlands, but tractors, wheeled skidders, and other ground-based logging systems may be used only when soil moisture is low or the ground is frozen. At all times, equipment use must minimize compaction or disturbance of the soils. In contrast to State regulations, the HCP contains the prescription that, where possible, forested wetlands are left in a forested condition (i.e., retain a canopy closure of 30 percent). Plum Creek allows only one entry every 50 years to each wetland buffer. Leave-trees comply with the State specifications, but leave trees are also representative of pre-harvest tree sizes and species.

Ground-based equipment is not allowed within: (1) A nonforested wetland; (2) 25-feet of a nonforested wetland edge, where the wetland exceeds 0.5 acres; and (3) 25 feet of an open water area associated with a forested wetland, where the wetland exceeds 0.5 acres.

In planning roads and landings, Plum Creek attempts to avoid wetlands. If wetlands cannot be avoided, Plum Creek will reduce impacts by minimizing subgrade width and spoil areas. If Plum Creek is unable to minimize impacts, the Company will restore affected areas, reduce impacts, or replace affected wetlands as specified by State Forest Practices Rules and Regulations. Also, if a particular road segment necessitates filling or draining more than 0.5 acres of wetland, the Company will compensate for that fill (or drainage) by creating new wetlands or by enhancing existing wetlands.

Road Management

Plum Creek's management objective for roads is to minimize disturbance of RHAs and to prevent sediment delivery to streams. If a road is required to be built through an RHA, Plum Creek will implement the Company's road building/ maintenance practices (HCP Section 1.2.3.4) and implement specific measures to reduce the potential effects of road construction and use on streams and riparian habitat areas by:

1. Minimizing road building activity - In addition to posing potential environmental impacts to riparian and aquatic habitats, road networks are a major management cost both in terms of construction and ongoing maintenance. For these reasons, Plum Creek's policy is to construct the minimum amount of roadway necessary to harvest timber safely and economically and conduct subsequent management activities.
2. Minimizing disruption of natural hydrologic-flow patterns - All roads constructed by Plum Creek are located to minimize impacts to natural hydrologic flow patterns. Culverts and/or bridges are placed at all water crossings, and where needed, additional culverts are installed for cross drainage or ditch-line relief.

3. At sites requiring culverts greater than 30 inches in diameter, appropriate culvert size is determined by analyzing such factors as terrain, watershed area, annual precipitation, and rainfall intensity. Restricting sidecasting during construction to prevent the introduction of sediment into streams and riparian habitat areas - Excavated soils are typically used as fill material to form a portion of the subgrade on terrain under 60 percent sideslope; however, on slopes exceeding 60 percent, all excavated material is end-hauled and disposed of at a stable site, and sidecasting is prohibited.
4. Minimizing erosion at road sites using advanced techniques - Erosion at road sites is controlled by a variety of techniques including cross drainage or ditch-line relief features to minimize water velocity, armoring (stabilizing) culvert head walls, and construction of stable cut-and-fill slope angles. Additional erosion-control measures typically used at road-construction sites include grass seeding, sediment filters, straw matting, ditch-line energy dissipaters, and appropriately placed riprap.
5. Identifying roads and associated drainage features that pose a potential risk - Plum Creek inspects and maintains roads as needed to ensure proper drainage function and subgrade stability. The overall maintenance plan for all Plum Creek roads is developed in collaboration with the WDNR, and is in compliance with Washington State's Forest Practices Board Rules and Regulations.
6. Closing or stabilizing roads based on short-term and long-term transportation needs in each watershed -Plum Creek conducts regular assessments of the Company's short-term and long-term transportation needs. Decisions regarding which roads need to remain open and maintained, and which roads should be decommissioned and stabilized are made on a watershed basis. Plum Creek's decision to decommission versus continuing to maintain a road is based on an environmental and cost/benefit analysis. In any event, decommissioning plans must be approved by the WDNR. Road decommissioning techniques include: (1) removal of culverts; (2) grass seeding; (3) strategic placement of biomatting; and (4) construction of sediment traps. With decommissioning, Plum Creek typically places a gate or barrier on the road to discourage public access, but leaves most of the road bed in place, facilitating reconstruction should the need arise (i.e., fire access, administrative use, or management emphasis change), but hydrologic risks are greatly reduced.
7. Limiting right-of-way size - the smallest possible right-of-way clearing that allows for safe construction and passage on roads is used; and
8. Limit length of reach impacted - roads cross all streams at right angles.

Harvest Deferrals for 303(d) Stream Segments and Wetland Management Zones - To address specific water-quality concerns, special consideration is given to fish-bearing streams and adjacent habitat areas that have been listed by the Washington State Department of Ecology as water-quality limited. Within the Action Area, stream segments in four drainages (i.e., Big Creek, West Fork Teanaway, Lookout Creek, and Gold Creek [tributary to Naches River]) are considered as water-quality limited under section 303(d) of the Clean Water Act. All stream segments were listed because stream temperatures exceeded State water-quality standards. In order to improve environmental conditions in these streams in support of beneficial uses such as fisheries habitat, Plum Creek is deferring harvest within 667 acres in RHAs adjacent to the 303(d) listed stream segments until watershed analysis is completed in each watershed (HCP Figure 27), and within 1,320 acres in wetland management zones (WMZs) surrounding wetlands (HCP Section 3.3.4). Watershed analysis will address the water-quality parameters typically impacted by forest practices such as stream temperature, turbidity, and sediment input.

Watershed Analysis

Watershed analysis is used regularly by Plum Creek in watersheds on its lands in the central Cascade Mountain Range. Watershed analysis is also a major component of the HCP. Habitat quality for salmonids is also being assessed through the watershed analysis process, as practiced according to the HCP (Toth 1995).

Watershed analysis is a systematic procedure to assess local physical and biological processes within a watershed, and generates information for developing management guidelines that protect and restore aquatic and riparian habitat. Watershed analyses conducted in the HCP Planning Area assess the natural physical and biological processes operating in different watersheds and provide Plum Creek with the local information necessary to protect and restore riparian and aquatic resources and allow for compatible timber management in the HCP Planning Area. Watershed analysis will be the primary procedure for developing and documenting scientifically-based information of the ecological structures, functions, processes, and interactions occurring within each watershed. A detailed description of recommended methodologies for conducting watershed analysis is found in the Washington Forest Practices Board Manual: *Standard Methodology for Conducting Watershed Analysis, Version 2.1* (WFPB 1994). A more detailed description of the watershed analysis procedures is shown in Toth (1995).

Watershed analysis for State and private lands in Washington is a regulatory process administered by the WDNR. The WDNR has divided the State into approximately 800 watersheds ranging in size from 10,000 to 50,000 acres. These watersheds are termed Watershed Administrative Units (WAUs). Either the WDNR or a private landowner with at least a 10 percent ownership in a basin can initiate a watershed analysis. There are 20 WAUs within the HCP Planning Area within which Plum Creek can initiate a watershed analysis (Toth 1995). All State watershed analyses consist of the following four distinct stages.

Stages of watershed analysis:

Watershed analyses are generally conducted in 4 distinct stages:

1. Resource Assessment - Scientific assessment of the watershed's conditions and resources.
2. Prescriptions - Methods of operating in the watershed to reduce or eliminate potential adverse impacts in the watershed. These are in addition to regular forest practice rules and regulations.
3. Public Review and Comment - Public review through the State Environmental Policy Act (SEPA).
4. Monitoring - Plans to track changes in watershed conditions and the effectiveness of the prescriptions.

A fundamental assumption of watershed analysis is that by applying "standard" forest practices in less-sensitive areas and managing sensitive areas with appropriate prescriptions from watershed analysis, the overall watershed condition will be protected and cumulative effects will not occur. Watershed analysis not only requires local scientific assessments, but it also relies upon continuous revisions as monitoring activities provide feedback on the condition of the resources within the basin.

The watershed analysis process used by Plum Creek to complete, for example, the Quartz Mountain WAU watershed analysis is discussed by Toth (1995). Briefly, the Quartz Mountain watershed analysis included the area drained by the North and South Forks of Taneum Creek in mountainous forest land east of the Cascade crest. Approximately 40 percent of the 29,409 acres in the WAU is owned by Plum Creek. The remaining 60 percent is administered mainly by the Forest Service. The most-pervasive problem identified in the WAU by watershed analysis is the excessive amount of fine sediment in Taneum Creek. Based on the resource assessment, 20 prescriptions were developed to improve the conditions of the watershed and to avoid potential problems in the future. A 5-year, road-improvement and maintenance plan was developed to reduce the amount of fine sediment entering the streams. The improvement and maintenance plan include placement of additional culverts, revegetation of cutslopes, and road closures. In addition, new roads will only be built if sediment production from all roads in the watershed is reduced to specified annual target levels.

Watershed Analysis Relationship to HCP

Watershed analysis is the primary procedure for developing and documenting scientifically-based information of the ecological structure, functions, processes, and interactions affecting aquatic resources within each watershed. Plum Creek completed a hierarchical ecological classification of the HCP Planning Area which incorporates geomorphology and hydrologic data necessary for watershed analysis (Jensen 1995; HCP Section 2.1). Watershed analysis provides the basis for implementing the ecosystem management objectives of the HCP related to aquatic resources. Evaluation of

watershed condition involves completion of watershed analysis in 20 Watershed Administrative Units (WAUs) within the HCP Planning Area. These watershed analyses include the following analyses:

1. stream channel and adjacent riparian habitat areas;
2. condition of adjacent uplands;
3. effects of previous natural disturbances and forest-management actions; and
4. landscape-level factors including percentage of area in rain-on-snow zones, percentage of this zone which supports hydrologically mature vegetation, and percentage of slopes which are at risk of mass wasting.

The results of watershed analysis allow Plum Creek to evaluate the processes and functions operating within each WAU in the HCP Planning Area, and to establish appropriate timber-harvest practices.

Watershed analyses completed and submitted by Plum Creek are still subject to public review and comment through the State Environmental Policy Act (SEPA) prior to approval and implementation of prescriptions developed for a particular watershed. There are 20 WAUs within the HCP Planning Area within which Plum Creek can initiate a watershed analysis (Toth 1995). Plum Creek has accelerated watershed analysis in these WAUs, and will submit to the Services all watershed analyses evaluations in the HCP Planning Area by 2002, except where Plum Creek and the Services make other arrangements to accommodate the schedules of Tribal participants. East of the Cascade Crest, Plum Creek has completed three Watershed Analyses through the SEPA phase (Quartz Mountain, Alps, Naches Pass), two in which the prescriptions have been completed (West Fork Teanaway, Big Creek), and two in which prescriptions have been initiated (Keechelus-Mosquito Creek, Cabin Creek).

Key components incorporated by Plum Creek in their watershed-analysis process include, measuring the RHA's from the outer edge of the channel migration zone, adopting interim and minimum RHA's on fishbearing streams, and agreeing to implement the otherwise voluntary monitoring module from State watershed analysis. Also, in accordance with watershed analysis, a Road

Maintenance and Abandonment Plan will be implemented. Some of the measures to reduce the effects of roads to anadromous fish resources, are found in Section 3 of the HCP.

Table 4. Summary of Watershed Processes and Resources Addressed by the Washington State Watershed Analysis Modules.

Watershed Analysis Module	Watershed Processes and Resources Addressed
<i>Mass Wasting</i>	<ul style="list-style-type: none"> • Debris Torrents • Landslides • Earthflows
<i>Surface Erosion</i>	<ul style="list-style-type: none"> • Hillslope Surface Erosion <ul style="list-style-type: none"> - Gullyng - Dry Ravel - Sheetwash • Road Erosion
<i>Hydrology</i>	<ul style="list-style-type: none"> • Peak Streamflows • Summer Low Flows
<i>Riparian Function</i>	<ul style="list-style-type: none"> • Large Woody Debris Recruitment • Shade/Water Temperature • Bank Stability
<i>Channel Condition</i>	<ul style="list-style-type: none"> • Historic Channel Disturbance • Current Channel Condition • Spatial Distribution of Channel Response Types • Dominant Habitat-Forming/Geomorphic Processes
<i>Fish Habitat</i>	<ul style="list-style-type: none"> • Distribution and Relative Abundance of Salmonids • Existing Habitat Condition • Fish Habitat utilization and Preferences
<i>Water Supply / Public Works</i>	<ul style="list-style-type: none"> • Location & Sensitivity of Water Supplies and Public Works <ul style="list-style-type: none"> - Public State Roads and Bridges - Reservoir, Irrigation Surfaces - Municipal, Domestic, Hatchery Water Supplies

Aquatic Resources Monitoring

Habitat monitoring ensures that appropriate prescriptions have been implemented to protect fish and water quality. To ensure that the mitigation and minimization strategies are effective, the Habitat Conservation Plan incorporates a variety of aquatic monitoring components that will provide feedback for adaptive management. Where appropriate, monitoring methods used by Plum Creek conform to the Timber/Fish/Wildlife (TFW) survey methodology protocol (Shuett-Hames et al. 1993). Fish-habitat-monitoring methods include some combination of inventory assessment (baseline monitoring) and measurements over time (trend monitoring). Baseline monitoring is useful for characterizing existing conditions and establishing a database for future comparisons. Trend monitoring evaluates long-term changes in a particular parameter. Trend monitoring includes water-quality parameters such as water temperature and turbidity. Monitoring of importance to anadromous species includes the following types: Implementation monitoring, Habitat monitoring through watershed analysis, and Aquatic Monitoring (including effectiveness, water temperature, invertebrate indicators, and fish populations). Compliance monitoring along a broad array of prescriptions, terms, etc., will continue to be conducted by the Services.

As described in HCP Section 5.1.6, all aquatic-resources monitoring is directed at specific technical questions and concerns addressed by the riparian-management strategy. The Aquatic Resources Monitoring Program was designed to achieve four main objectives. These objectives include the following:

1. Provide landscape-wide monitoring of habitat conditions over the Permit period. This involves analysis of permanent channel cross-sections in the Green River and Yakima River Subbasins, and re-examination of conditions in 20 Watershed Administrative Units (WAUs) in the HCP Planning Area every 5 years for the first 10 years, and every 10 years thereafter throughout the Permit period to determine the effectiveness of prescriptions implemented for resource protection and recovery. For habitat conditions, Plum Creek conducts bank-full and low-flow cross-sectional and longitudinal channel profiles, Wolman pebble counts, large woody debris counts, permanent photo points to document changes in channel morphology and substrate composition, and measurement of the frequency and residual volume of pools.
2. Analyze the effects of the various riparian habitat areas (RHAs) management strategies on stream temperatures. Plum Creek will initiate a study to measure potential differences in stream temperatures for the four RHA strategies described in HCP Section 3.3.3.1. The strategies include all Plum Creek's RHA design types as well as 300-foot, no-harvest riparian buffers on fish-bearing streams on National Forest lands. Streams with verified populations of bull trout, or those on the Clean Water Act 303(d) list, will be monitored for stream temperature at a minimum of two locations per stream. Diurnal fluctuations and maximum annual temperature will be evaluated. Known bull trout streams will have additional temperature measurements to monitor conditions during the spawning season, and to evaluate the effects of groundwater input on stream temperature, to determine reasons for any elevated

temperatures, and to evaluate the effectiveness of prescriptions contained in the HCP and identified during watershed analysis. Ambient air temperature will also be monitored.

3. Assess fish populations in the context of recovery of habitat conditions in Cabin Creek. Cabin Creek has had a history of disturbance during the past 20 years, and during this period, the watershed was intensively managed for timber production. Intensive monitoring of the watershed will provide an opportunity for Plum Creek to measure changes in fish populations as habitat recovers from the past disturbances. Monitoring procedures (surveys) for bull trout, with its listing under the Act, will become subject to a 10(a)(1)(A) permit and all the attendant conditions. The methodology developed by Hillman and Platts (1993) involves both day snorkeling and electroshocking, as well as potential handling during identification.
4. Assess the biological integrity of streams in the HCP Planning Area over the Permit period. Long-term monitoring of aquatic macroinvertebrate species composition and abundance in the Little Naches River will provide information on watershed health that physical habitat measurements alone may not reflect.

Plum Creek will also conduct watershed analysis and re-evaluations of watershed analyses to provide updated information on hillslope conditions, stream channel conditions, and the effectiveness of resource-protection prescriptions. Examples of monitoring and research done as a result of watershed analysis include: (1) a road sediment production study; (2) McNeil sampling of streams to assess fine sediment levels; (3) installation of stream gages; (4) testing of digital elevation hydrologic models; (5) stream temperature monitoring; and (6) stream surveys to evaluate channel changes and large woody debris levels. If monitoring results indicate that prescriptions are ineffective or inadequate, the prescriptions will be changed to make them effective and adequate.

A complete description of the aquatic monitoring protocols is in section 5 of the HCP. The complete schedule of monitoring and reporting is presented in HCP Table 31.

RHA Design and Fish Habitat Protection

All species of fish are sensitive to thermal fluctuations, suspended sediment, and alterations in streamflow regime; salmonids (such as bull trout) are especially sensitive to any changes in the freshwater environment. For this reason, Plum Creek assumed that by addressing the biological needs of the most-sensitive fish species (i.e., bull trout and other salmonids), the environmental requirements for successful spawning and rearing of all other fish species in the HCP Planning Area would be adequately protected as well.

Vegetation in the RHAs provide a number of functions for maintaining stream processes including bank stability from root strength; large woody debris input for pool formation, sediment storage and habitat complexity; nutrient input for aquatic organisms; and shade for moderation of stream temperatures. Most effects of riparian vegetation on streams decreases with increasing distance from

the streambank (VanSickle and Gregory 1990; McDade et al. 1990). As a general rule, the riparian width that can affect fish habitat is approximately one tree height in length (HCP Figure 35) (Beschta et al. 1987; Robison and Beschta 1990; USDA 1993).

In summary, until watershed analysis is completed, Plum Creek will continue to implement the interim and minimum guidelines described earlier. The 30-foot, no-harvest zone provided adjacent to fish-bearing streams maintains root strength and stream bank integrity. Plum Creek also maintains forest conditions equal to or greater than foraging-dispersal habitat for spotted owls in RHAs along all perennial streams, and address aquatic resource protection using 200-foot RHAs on all fish-bearing streams and 100-foot RHAs on perennial, nonfish-bearing streams. By providing the equivalent of at least one tree height of protection for fish-bearing streams, litter fall and stream shading are fully maintained, and the 200-foot RHAs on fishbearing streams are expected to provide, at a minimum, 85 percent, and in most instances, up to 100 percent of the large woody debris inputs that occurred under natural conditions. Watershed analysis will identify prescriptions that may be implemented to further protect streams.

The results of watershed analysis process and the aquatic monitoring strategy provides a feedback loop that can modify prescriptions of the HCP. Thus, if the results of either process indicate a more conservative approach to riparian management is warranted, the new information will be used and new management prescriptions will be implemented. Watershed analysis can only increase (not decrease) the level of protection these streams and sensitive areas receive.

These minimization and mitigation measures described above represent the minimum level of riparian conservation that Plum Creek has committed to implement. Several aspects of the Habitat Conservation Plan, including watershed analysis and riparian protection, are subject to adaptive management as described herein. If additional actions are necessary to protect bull trout, adjustments would be made to watershed analysis-derived prescriptions and to the interim and minimum buffer prescriptions.

Flexibility and Amendments

The Service also anticipates that Plum Creek will exercise flexibility in the conduct of this HCP. For instance, stand-structure amounts are allowed to vary within prescribed limits. Yarding corridors that conform to HCP limitations may be placed at Plum Creek's discretion. The Service analyzed the impacts to species associated with the lower amounts of habitat. The HCP Table 32 depicts the impacts to habitat amounts and species (by Lifeform). For Lifeforms 2 and 3, primary habitat is dispersal forest and older within the riparian habitat areas. As depicted in HCP Table 32, over 70 percent of the RHAs are expected to be older than or equal to dispersal forest in the HCP Planning Area (even with a reduction of 90 percent in each stand structure stage) by year 2045.

The HCP maintains the ability for Plum Creek to institute minor changes to the HCP upon consultation with the Services such as changing locations of or adding owl deferrals, changing boundaries of owl-survey areas, or conducting actions between 0.25 and 0.5 miles of a wolf den outside the denning season. Similar minor variances could be developed to benefit fish and wildlife

resources. For instance, some riparian stands may benefit from a 2-stage thinning. Such variances would be closely scrutinized and would be relatively rare. Adaptive management is another mechanism for change. Results from the monitoring and research program may indicate that additional conservation is required, and the HCP provides enough flexibility to incorporate such knowledge into revised prescriptions. Amendments may be proposed by either the Services or Plum Creek at any time during the Permit Period. These amendments may be treated as minor changes or material amendments depending on the Services assessment of the level of change and impact (IA Section 7.3.2).

The HCP assumed that some level of land exchange was possible and, as such, provided various mechanisms to incorporate such exchange (HCP Section 5.3.4). Exchanges or disposition may be made to private, State, or Federal entities and will be subject to the provisions of the IA and HCP to ensure the integrity of the HCP is maintained. The Service would expect to prepare an addendum to the HCP describing any such changes in survey areas, ownership, deferral locations, or changes made to prescriptions, definitions, or site-specific actions where such changes are not material to the functioning of the HCP.

As specified in the IA, should any of the currently unlisted species subsequently become listed, Plum Creek may request an amendment to the incidental take permit to include such vertebrate species. If an amendment request is received, the Service and/or NMFS will reinitiate consultation under Section 7 of the Act and initiate amendment of the HCP. Such an amendment will: (1) present relevant existing information on the status, trend, or other information pertinent to the HCP Planning Area; (2) estimate the amount of take and the impacts of such take; (3) describe the ongoing minimization and mitigation steps the applicant is taking or will take relative to that species; (4) describe any additional actions that were found to be necessary or appropriate to successfully complete an amendment for that species; and (5) explain how each of the issuance criteria described in Section 10 (2)(B) are being met. Such amendment should cite the Federal Register documents used in proposed, emergency, or final listing; cite any pertinent draft recovery plan effort or similar management plans for the species or its habitats; and must consider the other obligations of the Services as Federal agencies. It is expected that, upon listing of a currently unlisted species, additional information will be available in any proposed, final, or emergency listing to determine the habitat and life-history requirements of the species, the range-wide status, threats to the species, applicable management recommendations, and other basic information necessary to complete the amendment and reinitiation processes. Before such species would be added to the permit, the Service must find that adding the species to the permit would not appreciably reduce the likelihood of survival and recovery of the affected species in the wild and would be consistent with its other responsibilities.

Upon termination of the 50-year Phase I, the permit may extend for an additional 50 years for certain species or habitats. This extension (Phase II) is described more fully and the impacts of Phase II are analyzed in HCP Section 5.3.3. The ability to extend the permit into Phase II of this project provides Plum Creek with incentives to provide additional habitats voluntarily. If Phase I is completed, this provision will ensure that, for species to be covered by this "Safe Harbor" provision, conditions will be maintained at levels above that anticipated for year 50. If Phase I is not fully completed, Phase II would not be granted unless conditions exceed the higher of today's condition or that predicted to

occur at year 50. This establishes a very high threshold that provides an additional incentive to complete Phase I of the permit. During Phase II, applicable provisions of the HCP will apply and take-minimization efforts will be employed. Some provisions only apply during Phase I, and others would apply in Phase II if the species being covered are dependant on the habitat types or actions involved. Some actions are more likely to occur in Phase II than others. For instance, habitat-amount commitments in RHAs are very likely to continue regardless of the species involved; whereas minimization of road building would depend heavily upon the species involved. If a cave-dependant species were listed on the permit during Phase II, then protection of caves as specified in the HCP must continue as well. Concurrent with the 40-year report, Plum Creek will submit a request identifying the species for which it desires to implement Phase II provisions. The IA provides the Service with an opportunity to assess whether Phase II would be warranted.

In the event that a change to the HCP is deemed desirable or necessary by the Services, the Services have the following opportunities to effect change (presented in hierarchal order of urgency):

1. Request Plum Creek to avail itself of the HCP flexibility.
2. Utilize, where applicable, the provisions for consultation with the Services.
3. Utilize, where applicable, the adaptive-management process.
4. Propose either minor changes or material amendments.
5. Seek additional mitigation from nearby Federal lands.
6. Require redistribution of conservation measures as a result of extraordinary circumstances.
7. Terminate permit with respect to that species, where necessary, to avoid appreciably reducing the likelihood of survival and recovery of the species in the wild.

In the case of extraordinary circumstances, the Service must first seek mitigation from Federal lands, and only where protective measures on Federal lands are insufficient, may it impose additional mitigation upon Plum Creek.

Covered Species

The HCP considered and some provisions of the IA address all vertebrate species which may use the habitats which are present within the HCP Planning Area. These vertebrate species include not only the 285 known vertebrate species inhabiting the area which were specifically named and addressed in the HCP and its supporting technical papers, but additional species as well.

The listed species which are covered by the current permit include the northern spotted owl, the marbled murrelet, the gray wolf, and the grizzly bear. The IA describes the process by which additional vertebrate species may be added to the permit in the future. This Biological Opinion only considers the Columbia River distinct population segment of bull trout. Should additional species become listed, or should Plum Creek request that the bald eagle or peregrine falcon be added to the Permit, reinitiation would be necessary. In that event, reinitiation should be facilitated by this Biological Opinion, the HCP, the Section 10 findings, and any applicable recovery plan or notice of listing.

STATUS OF THE SPECIES (rangewide)

The bull trout has been the subject of much discussion since the late 1970's when the species was formally recognized as distinct from Dolly Varden (*Salvelinus malma* Girard). Fisheries managers previously had little concern for them and, in some cases, tried to exterminate them. Habitat degradation and other factors also contributed to a long-term decline. Most recently, concern for bull trout has stemmed from its greater vulnerability to legal and illegal harvest and recognition of its narrower environmental tolerances when compared to other salmonids.

Taxonomy

Bull trout are a member of the char family, which also includes the arctic char (*Salvelinus alpinus*) and the Dolly Varden trout. Bull trout are closely related to Dolly Varden trout and are sympatric with Dolly Varden over part of their range, most notably in the Puget Sound Region of Washington State. The taxonomic classification between these two char has been fraught with difficulty. For years, the bull trout and Dolly Varden were combined under one name, the Dolly Varden (*Salvelinus malma* Walbaum). In 1991, with the support of the American Fisheries Society, bull trout and Dolly Varden were recognized as two distinct species.

Description

Characteristics distinguishing the two species as well as a taxonomic description of bull trout are presented by Haas and McPhail (1991). Two of the most useful characteristics in separating the two species are the shape and size of the head (Cavender 1978). The head of a bull trout is more broad and flat on top, being hard to the touch, unlike Dolly Varden. Bull trout have an elongated body, somewhat rounded and slightly compressed laterally, and covered with cycloid scales numbering 190-240 along the lateral line. The mouth is large with the maxilla extending beyond the eye and with well-developed teeth on both jaws and head of the vomer (none on the shaft). Bull trout have 11 dorsal fin rays, 9 anal fins, and the caudal fin is slightly forked. Although they are often olive green to brown with paler sides, color is variable with locality and habitat. Their spotting pattern is easily recognizable showing pale yellow spots on the back, and pale yellow and orange or red spots on the sides. Bull trout fins are tinged with yellow or orange, while the pelvic, pectoral, and anal fins have white margins. Bull trout have no black or dark markings on the fins.

Historical and Current Distribution

Bull trout are native to North America (Morton 1970) and are distributed from 41 to 60 degrees North latitude along the Cascade and Rocky Mountain ranges (Meehan and Bjornn 1991). Bull trout also occur in the headwaters of North and South Saskatchewan Rivers of the Hudson Bay drainage in Alberta, and in the headwaters of the Athabaska, Peace, and Laird Rivers tributary to the Mackenzie River system in Alberta and British Columbia (Cavender 1978; Haas and McPhail 1991). South of the 49th parallel, bull trout occur mainly west of the continental divide in river systems that drain the Columbia River basin, except in Montana and Oregon (Platts et al. 1993).

The historical range of bull trout was restricted to North America (Cavender 1978; Haas and McPhail 1991). Bull trout have been recorded from the McCloud River in northern California, the Klamath River basin in Oregon and throughout much of interior Oregon, Washington, Idaho, western Montana, and British Columbia, and extending into Hudson Bay and the St. Mary's River in Saskatchewan.

Bull trout are believed to have developed periglacially and to be a glacial relict (McPhail and Lindsey 1986), and their broad distribution has probably contracted and expanded periodically with natural climate change (Williams et al., 1997). Bull trout likely entered certain basins by lake formations caused by ice dams, and subsequent spilling of lake waters into new basins or through river piracy. Genetic variation suggests an extended and evolutionarily important isolation between populations in the Klamath and Malheur Basins and those in the Columbia River basin (Leary et al. 1993). Populations within the Columbia River basin are more closely allied and are thought to have expanded from common glacial refugia or to have maintained higher levels of gene flow among populations in recent geologic time (Williams et al. 1997).

Bull trout are now extinct in California and only remnant populations are found in much of Oregon (Ratliff and Howell 1992). A small population still exists in the headwaters of the Jarbidge River, Nevada, which represents the present southern limit of the species' range.

It is unlikely that bull trout occupied all of the accessible streams at any one time. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin (Quigley and Arbelbide 1997). Distribution of existing populations is often patchy even where numbers are still strong and habitat is in good condition (Rieman and McIntyre 1993; Rieman and McIntyre 1995). Habitat preferences or selection is likely important (Dambacher and Jones 1997; Goetz 1994; Rieman and McIntyre 1995) but more stochastic extirpation and colonization processes may influence distribution even within suitable habitats (Rieman and McIntyre 1995).

However, multiple human-induced factors have contributed to strongly influence the present day distribution of anadromous salmonid species, included among them are the creation of migration blockages (dams, diversions, etc.), in-river and ocean harvest, and estuarine and freshwater habitat alteration. These limiting factors were analyzed in preparation of the Plum Creek HCP, by Watson and Toth (1995) and are included herein by reference. The present day anadromous salmonid distribution reflects these natural and human-induced factors.

The historical distribution of bull trout in Washington includes most of the State except that portion south and east of the Columbia River, but north of the Snake River, in eastern Washington; and, in the extreme southwest portion of the State, that portion west of the Lewis River to Grays Harbor, but south of the Nisqually River Basin (HCP Figure 31) (Mongillo 1993). Reductions in the historical distribution of bull trout has occurred mainly in eastern Washington. As an example, bull trout populations are currently absent from the Chelan, lower Yakima, and Okanogan basins (Brown 1992). Although it is presumed that bull trout were once widely distributed throughout the Columbia basin, presently they are only occasionally observed in the Columbia and Snake Rivers (Brown 1992). The Columbia River distinct population segment encompasses the entire Columbia Basin and all its tributaries, excluding the isolated bull trout populations found in the Jarbridge River, and does include the eastern Cascades. The Service recognizes 141 subpopulations in the Columbia River distinct population segment within Idaho, Montana, Oregon, and Washington with additional subpopulations in British Columbia (63 FR 31647) (USFWS 1998b).

Biological Status

Rangewide, populations are generally isolated and remnant. The Columbia River district population segment has declined in overall range and numbers. Though still relatively widespread in distribution, there have been numerous extirpations reported throughout the Columbia River Basin with bull trout eliminated from areas ranging in size from relatively small tributaries of currently occupied, though fragmented, habitat, to large river systems comprising a substantial portion of the species' previous range. Migratory life histories have been lost or limited throughout the range (Goetz 1994; Jakober 1995; Montana Bull Trout Scientific Group 1998; Pratt and Huston 1993; Ratliff and Howell 1992; Rieman and McIntyre 1993, 1995) and fluvial bull trout populations in the upper Columbia River portion of the distinct population segment appear to be nearly extirpated. Resident populations existing in headwater tributary reaches are isolated and generally low in abundance (Thomas 1992). Bull trout in Flathead Lake and Lake Pend Oreille appear to be declining, while the Swan Lake adfluvial population appears to be the healthiest remaining population and is increasing (USDI 1998b). Generally, where status is known and population data exists, bull trout populations in the entire Columbia River distinct population segment are declining (Thomas 1992; Pratt and Huston 1993; Schill 1992). Presently bull trout in the Columbia basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide 1997). The population segment is composed of 141 subpopulations, which indicates the level of habitat fragmentation and geographic isolation. Of the 141 subpopulations, 75 are at risk of natural extirpation through physical isolation. Many of the remaining bull trout occur as isolated subpopulations in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout subpopulations are considered "strong" in terms of relative abundance and subpopulation stability. Those few remaining strongholds are generally associated with large areas of contiguous habitats such as portions of the Snake River basin in Central Idaho, the Upper Flathead Rivers in Montana, and the Blue Mountains in Washington and Oregon. The decline of bull trout is due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction of non-native species. Most bull trout subpopulations are affected by one or more threats (63 FR 31647).

Life History Characteristics

Like other char, bull trout have multiple life-history forms (morphologies), complex age structures, behavior, and maturation schedules. Two distinct life-history forms, migratory and resident, occur throughout the range of bull trout (Pratt 1992; Rieman and McIntyre 1993). Migratory forms rear in natal tributaries for several years before moving to larger rivers (fluvial form), lakes (adfluvial or lacustrine form), or the ocean (anadromous) to mature (Goetz 1989; Brown 1992; Rieman and McIntyre 1993). Migratory bull trout may use a wide range of habitats ranging from first to sixth order streams and varying by season and life stage. Resident populations are generally found in small headwater streams where they spend their entire lives. Stream-resident bull trout occupy small, high-elevation streams. They rarely move and are seldom larger than 30 centimeters (Goetz 1989). Many "resident" subpopulations were once migratory, but now they only occupy remnants of their range.

Bull trout become sexually mature from 4 to 9 years old (Shepard et al. 1984). Most bull trout spawning occurs between late August and early November (McPhail and Murray 1979; Pratt 1992; Shepard et al. 1984; Rieman and McIntyre 1996). Bull Trout require a long period of time (over 220 days) from deposition of eggs until emergence. Hatching occurs in winter or early spring, and alevins may stay in the gravel for extended periods. Growth is variable with different environments, but first spawning is often noted after age four, and the fish may live 10 or more years (McPhail and Murray 1979; Pratt 1992; Rieman and McIntyre 1993). Bull trout spawn in consecutive or multiple years (Shepard et al. 1984; Pratt 1992).

Although spawning typically occurs in second to fifth order streams, juveniles may move upstream of reaches used by adults for spawning, presumably to forage in other accessible waters (Fraley and Shepard 1989; Ratliff 1992). Although some individuals may spend their entire life in a small segment of a stream, most are highly migratory, traveling to headwater streams to spawn and later migrate back to larger stream segments or lakes to rear (McPhail and Murray 1979). Seasonal movements by adult bull trout may range up to 300 km as migratory fish move from spawning and rearing areas into overwinter habitat in the downstream reaches of large basins (Bjornn and Mallet 1964; Shepard et al. 1984; Elle and Thurow 1994). Post-spawning mortality, longevity, and repeat-spawning frequency are not well known (Rieman and McIntyre 1996).

Adfluvial bull trout mature in lakes or reservoirs and spawn in tributary streams. Fluvial forms have a similar life history as adfluvial forms, except they move frequently between mainstem rivers and smaller tributary streams. Juveniles remain between one to six years in nursery streams before migrating downstream to either rivers (i.e., fluvial forms) or lakes (i.e., adfluvial forms) (Fraley and Shepard 1989; Brown 1992). Anadromous bull trout spawn and rear initially in streams, and migrate to saltwater where they grow and mature (Brown 1992). They feed on a variety of water-column organisms and bottom dwellers (Thompson and Tufts 1967; Shepard et al. 1984; Pratt 1984).

Habitats Utilized

Even though bull trout may move throughout whole river basins seasonally, spawning and juvenile rearing appear to be limited to the coldest streams or stream reaches. The lower limits of habitat used by bull trout are strongly associated with gradients in elevation, longitude, and latitude, that likely approximate a gradient in climate across the Basin (Goetz 1994). The patterns indicate that spatial and temporal variation in climate may strongly influence habitat available to bull trout. While temperatures are probably suitable throughout much of the northern portion of the range, predicted spawning and rearing habitat are restricted to increasingly isolated high-elevation or headwater "islands" toward the south (Goetz 1994; Rieman and McIntyre 1995).

Although bull trout may be present throughout large river basins, spawning and rearing fish are often found only in a portion of available stream reaches. Migratory forms may use much of the river basin through their life cycle, but rearing and resident fish often live only in smaller tributaries.

Bull trout typically spawn in cold, low-gradient second- to fourth-order tributary streams, over loosely compacted gravel and cobble having groundwater inflow (Shepard et al. 1984; Brown 1992; Rieman and McIntyre 1996). Spawning sites also seem to be near cover (Brown 1992) such as logs, undercut banks, and boulders.

Preferred bull trout rearing habitat occurs in small headwater and tributary streams. Juveniles may move upstream of reaches used by adults for spawning, presumably to forage in other accessible waters (Fraley and Shepard 1989; Ratliff 1992). Juveniles (less than 100 mm) are primarily bottom-dwellers, occupying positions above, on, or below the bottom. Juveniles require cold-water tributaries with good cover (rocks and debris) and relatively little streambed sediment. Fry are found in shallow, slow, backwater side-channels and eddies (Shepard et al. 1984; Elliott 1986).

Older individuals are found in deeper and faster water compared to juveniles. Adults are often found in pools sheltered by large, organic debris or "clean" cobble substrate (McPhail and Murray 1979). Migratory bull trout may use a wide range of habitats ranging from first- to sixth-order streams and varying by season and life stage. In intermountain areas, lower-elevation lakes and rivers constitute important habitats for maturing and overwintering fluvial and adfluvial bull trout. Resident populations are generally found in small headwater streams where they spend their entire lives. Stream resident bull trout occupy small, high-elevation streams.

Habitat-Component Requirements

Rieman and McIntyre (1993) stated that bull trout appear to have more-specific habitat requirements than other salmonids. They list the habitat characteristics of temperature, cover, substrate composition, channel stability, and migratory corridors as important influences in bull trout distribution and abundance. Bull trout growth, survival, and long-term population persistence appear to be dependent upon these five habitat characteristics. In general, it is believed bull trout need habitat providing cold, clean water, complex cover, stable substrate with a low percentage of fine sediments, high channel stability, and stream/population connectivity. Although bull trout may be

present throughout large river basins, spawning and rearing fish are often found only in a portion of available stream reaches. Migratory forms may use much of the river basin through their life cycle, but rearing and resident fish often live only in smaller tributaries.

Bull Trout are strongly associated with various components of habitat complexity, including cover in the form of large woody debris, side channels, undercut banks, boulders, pools, and interstitial spaces in coarse substrate. Bull trout occupy a variety of habitat types during their life but are strongly associated with pools and large woody debris in the stream. Large pools, consisting of a wide range of water depths, velocities, substrates, and cover are characteristic of high-quality bull trout habitat (Watson and Hillman 1977). Preferred bull trout rearing habitat occurs in small headwater and tributary streams. As bull trout mature they move from slow backwater areas with large woody debris into deeper and faster water, such as runs and mainstream pools, but these pools are typically associated with large woody debris. Cover includes undercut banks, large woody debris, boulders, and pools which are used as rearing, foraging, and resting habitat, and protection from predators. Deep pools also help minimize and moderate stream temperatures and offer refuge from warmer water temperatures during summer low-flow conditions. Stream temperatures and substrate types are especially important to bull trout. Spawning occurs in the upper reaches of clear streams in areas of flat gradient, uniform flow, and uniform gravel or small cobble. Spawners require hiding cover such as logs and undercut banks. Strict habitat requirements make spawning and incubation habitat for bull trout limited and valuable (Fraley et al. 1989).

Surface/groundwater interaction zones, which are typically selected by bull trout for redd construction, are increasingly recognized as having high amounts of dissolved oxygen; constant cold water temperatures; and increased macro-invertebrate production. The maintenance of riparian vegetation is essential for controlling stream temperature, providing cover, and protecting against lateral erosion (WDW 1991). Maintenance of streamside vegetation contributes to canopy density (shading) and reduces sedimentation. Suppressing solar radiation avoids artificially raising stream temperatures, thereby assisting spawning, hatching, and rearing survival. Keeping sedimentation to near-natural levels contributes to the maintenance of spawning habitat and the diversity of aquatic invertebrates and other food items (Newbold et al. 1980).

Temperature

Rieman and McIntyre (1993) state that water temperature is consistently recognized by researchers more than any other factor as influencing bull trout distribution. Thermal barriers have contributed to the disruption and fragmentation of bull trout habitat (MBTSG 1998). Temperature is likely a critical habitat characteristic. Cold water temperatures are required for successful bull trout spawning and development of embryos and juveniles; cold water temperature also influence the distribution of juveniles (Bjornn and Reiser 1991; Goetz 1989; McPhail and Murray 1979; Pratt 1992; Fraley and Shepard 1989). Bull trout are associated with the coldest stream reaches within basins. Bull trout spawning typically occurs in areas influenced by groundwater (Allan 1980; Shepard et al. 1984; Ratliff 1992; Fraley and Shepard 1989). In a recent investigation in the Swan River drainage, bull trout spawning-site selection occurred primarily in stream reaches directly influenced by groundwater upwellings or directly downstream of these upwelling reaches (Watson and Hillman 1997). Warmer

summer stream temperatures, as well as extreme winter cold temperatures that can result in anchor ice, may be moderated by groundwater upwellings. Distribution is thought to be limited by temperatures above 15°C, while optimum incubation and rearing temperatures are thought to be much lower, 2 to 4°C and 4 to 8°C respectively (Goetz 1989, Pratt 1992). Water temperature seems to be an important factor in determining survival in the early life history of juvenile bull trout, with cool water temperatures resulting in higher egg survival and faster growth rates for fry and juveniles (Pratt 1992).

In one study by Goetz (1994), juvenile bull trout were not found in water temperatures above 12 degrees Celsius. Some studies have indicated that temperatures must drop below 9 or 10 degrees Celsius before spawning occurs (McPhail and Murray 1979; Riehle 1993). Egg survival decreases as water temperature increases, with higher survival levels documented at 2 to 4 degrees Celsius (McPhail and Murray 1979). The best bull trout habitat in several Oregon streams had temperatures which seldom exceeded 15 degrees Celsius (Buckman et al. 1992; Ratliff 1992; Ziller 1992).

Maintaining cold water temperatures is important for bull trout. Water temperature is controlled not only by shade (as influenced by canopy coverage of adjacent riparian stands), but by groundwater sources, sedimentation, influx of water from upstream areas, presence of large woody debris, elevation, and other factors.

Sediments

Sedimentation is shown to cause negative effects on bull trout, although no thresholds can be set as clear tolerance limits for population maintenance (Rieman and McIntyre 1993). Preferred spawning habitat includes low-gradient streams with loose, clean gravels (Fraley and Shepard 1989). Because bull trout eggs incubate about seven months in the gravel, they are especially vulnerable to fine sediments and water-quality degradation (Fraley and Shepard 1989). Fine sediments can fill spaces between the gravel that are needed by incubating eggs and fry. Juveniles can be similarly affected, as they also live on or within the stream-bed cobble (Oliver 1979; Pratt 1984).

Bull trout are more strongly tied to the stream bottom and substrate than other salmonids (Pratt 1992). Substrate composition has repeatedly been correlated with the occurrence and abundance of juvenile bull trout (Rieman and McIntyre 1993) and spawning-site selection by adults (Graham et al. 1981; McPhail and Murray 1979). Fine sediments can influence incubation survival and emergence success (Weaver and White 1985) but may also limit access to substrate interstices that are important cover during rearing and overwintering (Goetz 1994; Jakober 1995).

Emergence success of fry appears to be affected by the proportion of sediment in the substrate (Pratt 1992). Rearing densities of juvenile bull trout have been shown to be lower when there are higher percentages of fine sediment in the substrate (Shepard et al. 1984). The close association of young bull trout with the stream bed appears to be more important to bull trout than for other species (Pratt 1992; Rieman and McIntyre 1993). Due to this close connection to substrate, bed-load movements and channel instability can also negatively influence the survival of young bull trout.

Channel Complexity and Stability

Bull trout distribution and abundance is also positively correlated with complex forms of cover and with pools (Rieman and McIntyre 1993). Cover that bull trout are usually associated with consists of large or complex woody debris and undercut banks, but may also include coarse substrates (cobble and boulder). Studies conducted with closely related Dolly Varden showed that population density declined with the loss of woody debris after clearcutting or the removal of logging debris from streams (Bryant 1983; Murphy et al. 1986; Dolloff 1986; Elliott 1986).

Bull trout are exceptionally sensitive to activities that directly or indirectly affect stream-channel integrity. Juvenile and adult bull trout frequently inhabit areas of reduced water velocity, such as side channels, stream margins, and pools. These areas can be eliminated or degraded by management activities (Rieman and McIntyre 1993).

The association with substrate appears more important for bull trout than for other species, bull trout usually associate with complex forms of cover and with pools. Juveniles live close to in-channel wood, substrate, or undercut banks. Young-of-the-year use side channels, stream margins, and other areas of low velocity. The association with substrate suggests that highly variable stream flows, bed-load movements, and channel instability will influence the survival of young fish. Older fish use pools and areas with large or complex woody debris and undercut banks. Woody debris and habitat complexity (e.g., boulders and large rubble) has been significantly correlated with bull trout density estimates. Channel morphology is mainly a product of geomorphology, climate, and vegetation. Other factors include discharge, sediment load, bank characteristics, and channel roughness.

Stream Flow

Bull trout are also sensitive to activities that alter stream flow. Incubation to emergence may take up to 200 days during winter and early spring. The fall spawning period and strong association of juvenile fish with stream-channel substrates make bull trout vulnerable to flow-pattern changes and associated channel instability (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993; Rieman and McIntyre 1993).

Patterns of stream flow and the frequency of extreme flow events that influence substrates are anticipated to be important factors in population dynamics (Rieman and McIntyre 1993). With overwinter incubation and a close tie to the substrate, embryos and juveniles may be particularly vulnerable to flooding and channel-scour associated with the rain-on-snow events common in some parts of the range (Rieman and McIntyre 1993). Channel dewatering tied to low flows and bed-aggradation has also blocked access for spawning fish resulting in year-class failures (Weaver 1992). Recently, several investigations have explored the synergistic relationships between ground-water upwellings, stream gradient, substrate, and other habitat characteristics with the distribution and abundance of bull trout spawning (Watson and Hillman 1997; Ratliff 1987; Shepard et al. 1984; and Allan 1980).

Other recent work has highlighted the importance of tributary mouths to mainstem rivers in providing haven from excessive stream velocities and in providing seasonally cooler water (Swanberg 1996). The presence of shrubs and gravel bars in many mainstem rivers is similarly being investigated as important for escape from excessive stream velocities.

Migratory Corridors

Migratory bull trout ensure interchange of genetic material between populations, thereby promoting genetic variability. Unfortunately, migratory bull trout have been restricted or eliminated due to stream-habitat alterations, including seasonal or permanent obstructions, detrimental changes in water quality, increased temperatures, and the alteration of natural stream-flow patterns. Migratory corridors tie seasonal habitat together for anadromous, adfluvial, and fluvial forms, and allow for dispersal of resident forms for decolonization of recovering habitats (USDA 1993). Dam and reservoir construction and operation have altered major portions of bull trout habitat throughout the Columbia River Basin. Dams without fish passage create barriers to fluvial and adfluvial bull trout which isolates populations, and dams and reservoirs alter the natural hydrologic regime, thereby affecting forage, water temperature, and water quality (62 FR 32268).

Factors Affecting Viability

Factors limiting bull trout populations are complex and in some cases dependent upon the activities occurring within a particular watershed or subbasin. Throughout all subbasins State-wide, it appears that habitat destruction or modification is the most common factor affecting bull trout populations, followed by inadequate streamflow and water quality. Bull trout are sensitive to environmental disturbance at all life stages. Habitat degradation, impoundments and diversions, overharvest, and introduced species have each impacted bull trout in some way, and pose risks to bull trout in this distinct population segment.

Habitat Degradation

Bull trout are threatened by land-management activities and water-management activities which destroy, modify, or preclude use of their habitat. Logging and road-building activities affect bull trout through increased sediment production and delivery to streams, loss of large pools, increased stream temperatures, and loss of large woody debris. Roads can decrease slope stability by undercutting and steepening the slope, increasing weight from fill material, and altering drainage patterns for both surface and subsurface flow. It has been reported that over 100 times as many landslides occurred in forests that contained roads as compared to forests without roads.

Grazing can impair the function of riparian and aquatic habitats by promoting streambank erosion and sedimentation. Grazing can drastically limit the growth of riparian vegetation important for temperature control, streambank stability, fish cover, and detrital input, and can increase input of organic nutrients into streams (Platts 1991).

Watershed disruption has played a role in the decline of bull trout. Intermountain lakes and rivers at lower elevations which serve as overwintering habitat have been especially degraded by human activities, resulting in fragmented, isolated, local bull trout populations (MBTSG 1998). Within the range of the Northwest Forest Plan, there has been a 58 percent reduction in number of large, deep pools from historic levels. Changes in or disruptions of watershed processes likely to influence characteristics of stream channels are also likely to influence the dynamics and persistence of bull trout populations. Consequently, bull trout have been more strongly associated with pristine or lightly disturbed basins (Brown 1992; Clancy 1993; Cross and Everest 1995; Huntington 1995; Ratliff and Howell 1992). There are several recent treatments of the effects of forest management, especially forest roads, on bull trout (Baxter et al. In press; Quigley and Arbelbide 1997; Quigley et al. 1996; and Thurow et al. 1997). Thurow determined that increasing road densities and their related effects are associated with declines in four non-anadromous salmonid species (including bull trout). They found that most subwatersheds with strong salmonid communities have no roads or very low road densities. The remaining strong populations are generally located in areas with low-density road systems. They concluded, therefore, that addressing impacts from roads is extremely important when trying to protect critical bull trout habitat requirements through the development of land-management guidelines. However, they did not establish any causal linkage to roads. Roads may have been associated with other factors such as ownership patterns, topography, and access which also are known to affect bull trout in various ways (e.g., poaching, grazing, recreational uses).

Hicks (pers. comm. June 2, 1998) noted several weaknesses in the above-referenced analysis including assumptions and estimates of road densities and subjective ratings regarding the "health" of bull trout. He addressed the applicability of road density as a proximal predictor of bull trout density or habitat quality. Regression analysis was performed on 16 years of redd count data from 9 drainages in the Swan Valley. He analyzed road density and density of streams deemed important to bull trout based upon geomorphological conditions. None of the regressions comparing road density with bull trout population indicators were significant. The only regressions that were significant were those that compared stream guilds with bull trout density indicators. He concluded that any relationship that may be suggested between road density and bull trout density, is neither statistically relevant nor predictive in explaining bull trout "health". Consequently, it has less value than other physical habitat parameters that should be incorporated into landscape planning. He further stated that proximal effects of roads (e.g., sediment) on bull trout habitat can be better addressed by assessing road design, drainage conditions, and implementation of best management practices, rather than addressing road density alone.

Water-management Activities

Impoundments and diversions can create passage barriers to fish and can also be sources of direct mortality. These activities can contribute to low summer flows resulting in additional thermal barriers. Barriers to passage can break seasonal, exploratory, and population/genetic exchange movements. Impoundments provide opportunities for exotic species to become established and gain a competitive advantage. Private ponds can be a problem in some areas; illegal introduction is a

serious and growing problem. Water-management activities represent a combination of direct mortality, habitat destruction, fragmentation/isolation, flow alteration, and introduced species.

Physical blockages at mainstem impoundments have isolated whole subbasins. Water diversions and thermal barriers have barred access to former habitat. Development of downstream passage of adult bull trout have not been developed and efficiency of passing these individuals through juvenile passage facilities, or via spill, has not been thoroughly examined.

Overharvest

In some areas, angling has been and continues to be a threat to the bull trout. Bull trout may be vulnerable to over-harvest (Ratliff and Howell 1992; Rieman and Lukens 1979). Poaching may also be an important cause of mortality (USDI 1998). It is generally believed that current harvest levels are not the most limiting factor. A number of public-awareness campaigns have been launched to promote recovery efforts. The slogan "No black -- put it back" is becoming widespread with the assistance of streamside signage and public-awareness programs. Existing information clearly indicated bull trout had experienced serious declines in both historical abundance and distribution. There was also general agreement that angler overharvest in Alberta was the largest contributing factor to the declines in that Province, and that major changes to harvest policies were needed (Brewin 1997).

Overharvest of bull trout in the Columbia River basin, historically, likely contributed to their decline. In the past, harvest included legal recreational angling, poaching, and State-sponsored eradication programs (Thomas 1992). Bull trout were often targeted for removal by anglers and government agencies because bull trout preyed on salmon and other desirable species (Simpson and Wallace 1982; Bond 1992). As recently as 1990, State and Federal agencies instituted programs to eradicate bull trout through bounties and poisoning of waterways (June 10, 1998, Federal Register [63 FR 31647]).

Introduced Species

Introduced species also influence bull trout. More than 30 introduced species occur within the present distribution of bull trout. Non-native brook trout (*Salmo fontinalis*), lake trout (*S. namaycush*), and brown trout (*S. trutta*) may hybridize with or compete with bull trout. Some introductions like kokanee (*Oncorhynchus nerka*) may benefit bull trout by providing forage (Bowles et al 1991). Others such as brown, brook, and lake trout are thought to have depressed or replaced bull trout populations (Donald and Alger 1992; Howell and Buchanan 1992; Leary et al. 1993; Ratliff and Howell 1992). Brook trout are seen as an especially important problem (Kanda et al. 1997; Leary et al. 1993) and may progressively displace bull trout through hybridization and higher reproductive potential (Leary et al. 1993). Brook trout now occur in the majority of watersheds representing the current range of bull trout. Introduced species may pose greater risks to native species where habitat disturbance has occurred (Hobbs and Huenneke 1992). Bull trout and other char often thrive in waters too cold for other salmonid species. Cold temperatures can reduce the likelihood of invasion by brook trout and other non-native fish into bull trout watersheds (Clancy 1993; Frissell et al. 1995). Brook trout, which inter-breed with bull trout, may be more competitive

and may displace bull trout in streams containing more fine sediment and higher temperatures (Clancy 1993). Some man-made barriers may have unintentionally benefitted bull trout by preventing invasion of species such as brook trout or lake trout.

Population Structure

There are two ways that the above impacts of habitat land-use activities, water-management activities, overharvest, and introduced species might manifest themselves: (1) direct impacts to a given population or (2) affecting the link between populations.

Changes in sediment delivery; aggradation and scour; wood loading, riparian canopy and shading, or other factors influencing stream temperatures; and the hydrologic regime (winter flooding and summer low flow) are all likely to affect some, if not most, populations. Significant long-term changes in any of these characteristics or processes represent important risks for many remaining bull trout populations. Populations are likely to be most sensitive to changes that affect critical spawning and rearing reaches, existing population strongholds, or habitats supporting remnant (relictual) resident populations. Important refuge habitats are currently found primarily in undisturbed headwater areas and are a high priority for protection.

Isolation and Fragmentation

Historically bull trout populations were well-connected throughout the Columbia Basin. Habitat available to bull trout has been fragmented, and in many cases populations have been isolated. Dams have isolated sub-basins (Brown 1992; Pratt and Huston 1993; Rieman and McIntyre 1993). Irrigation diversions, culverts, and degraded mainstem habitats have eliminated or seriously depressed migratory life-forms effectively isolating resident populations in headwater tributaries (Brown 1992; Ratliff and Howell 1992; Rieman and McIntyre 1993). Introduced species like brook trout may displace bull trout in lower stream reaches, further reducing the habitat available in many remaining headwater areas (Adams 1994; Leary et al. 1993). Loss of suitable habitat through watershed disturbance may also increase the distance between good or refuge habitats and strong populations, thus reducing the likelihood of effective dispersal (Frissell et al. 1993). Because many of the bull trout populations in the Columbia Basin have been fragmented and isolated, those that remain are now very important for the conservation of the species. Of special importance are those populations that are documented to be reproducing, for which there is limited knowledge. Lack of connections places isolated stocks at greater risk to episodic and catastrophic events and stochastic localized extirpation without decolonization from nearby stocks. Migratory pathways allowing connections between these isolated strongholds or refugia or between key spawning and rearing reaches are necessary for the persistence and interaction of local populations as well as for long-term survival and recovery of the species. Disruption of migratory corridors can increase stress, reduce growth and survival, and lead to the loss of migratory life-history forms.

Legal Status

On October 30, 1992, the Service received a petition to list the bull trout (*Salvelinus confluentus*) as an endangered species throughout its range. On May 17, 1993, the Service published a 90-day petition finding determining that substantial information was provided indicating that listing of bull trout may be warranted. On June 6, 1994, the Service concluded in a 12-month finding that listing of bull trout throughout its range was not warranted due to unavailable or insufficient data regarding threats to, and status and population trends of, the species within Canada and Alaska. However, the Service determined that sufficient information on the biological vulnerability and threats to the species, along with higher priority listing efforts, were available to support a warranted but precluded finding to list the bull trout within the coterminous United States. On June 10, 1994 (59 FR 30254), the Services announced that the listing of the bull trout as a threatened or endangered species throughout the conterminous United States was warranted under provisions of the Act, but such listing was precluded by higher-priority species. In their decision, the Service indicated that bull trout populations in the lower 48 states were being elevated from Category 2 candidate species status to Category 1 candidate species status.

On November 1, 1994 a suit was filed in the Federal District Court of Oregon (Court) arguing that the warranted but precluded finding was arbitrary and capricious. The Service again issued the recycled 12-month finding for the coterminous population of bull trout on June 12, 1995. Therefore, after annual review, the warranted but precluded finding was reasserted in 1995 (60 FR 30825). On June 22, 1995, the Court issued an order declaring the 1994 challenge to the original finding moot because the Service had, by then, issued a 1995 finding. The court instructed the plaintiffs to amend their complaint to challenge the 1995 finding if they so desired. The plaintiffs declined to amend their complaint and appealed to the Ninth Circuit Court of Appeals. On April 2, 1996, the Ninth Circuit Court of Appeals overturned the District Court and remanded the case back to the District Court for further proceedings, ruling that this type of action was capable of repetition but evades judicial review. On November 13, 1996, the Court granted the plaintiffs' motion for summary judgement and issued an order and opinion remanding the original finding to the Service for further consideration, and included specific direction that the Service limit its review to the 1994 Administrative Record, only considering the information available and in the record at the time of the original 1994 finding. In the reconsidered 12-month finding, delivered to the Court on March 13, 1997, the Service concluded that the 1994 Administrative Record provided evidence of discreteness and significance for five distinct population segments): 1) Coastal/Puget Sound; 2) Klamath River; 3) Columbia River; 4) Jarbidge River; and 4) Saskatchewan River. Bull trout were delineated into distinct population segments because bull trout occur in widespread but fragmented habitats and have several life-history patterns. In addition, the threats to the fish are diverse, and the quantity and quality of information regarding the population status and trends of bull trout varies greatly. The Columbia River population segment includes the entire Columbia River basin and all its tributaries, excluding the isolated bull trout populations found in the Jarbidge River in Nevada. The reconsidered 12-month finding based on the 1994 Administrative Record concluded that listing was warranted for the Columbia River and Klamath River population segments, and not warranted for the Coastal/Puget Sound, Jarbidge River, and Saskatchewan River population segments.

On March 25, 1997, the plaintiffs petitioned the court to compel the Service to issue a proposed rule within 30 days to list the Klamath and Columbia River bull trout populations based on the 1994 record. In a stipulation between the Service and plaintiffs filed with the Court on April 11, 1997, the Service agreed to issue a proposed rule in 60 days to list the Klamath River population of bull trout as endangered and the Columbia River population of bull trout as threatened based solely on the 1994 record. On June 10, 1997, the Service proposed the Columbia River distinct population segment as threatened and the Klamath population as endangered. It published the proposed rule on June 13, 1997 (62 FR 32268).

On December 4, 1997, the Court ordered the Service to reconsider several aspects of the 1997 finding concerning listing of bull trout. The court directed the Service to: (1) Consider whether listing of the bull trout is warranted throughout its range; (2) Whether listing is warranted throughout the coterminous U.S.; and, (3) If the Service determines that listing throughout its range, or throughout the coterminous U.S. is not warranted, or is warranted but precluded, whether listing of the Coastal/Puget Sound distinct population segment is warranted. The Court subsequently directed the Service to prepare its response by June 12, 1998. On June 5, 1998, the Service announced the listing of the Klamath and Columbia River distinct population segments as threatened with publication of a final rule on June 10, 1998, effective July 10, 1998.

The State of Washington classifies bull trout as a State Priority Species. This Priority designation is given to those wildlife species that are of concern due to their population status and their sensitivity to habitat alteration (Mongillo 1993). Oregon has classified the bull trout as a sensitive/critical species, whose existence is being threatened in Oregon (Oregon Department of Fish and Wildlife 1993; Oregon Department of Fish and Wildlife 1995). California listed bull trout as an endangered species in October 1980 (California Department of Fish and Game 1995). The American Fisheries Society listed bull trout as a species of concern in all of its range (California, Idaho, Montana, Nevada, Oregon, Washington; Alberta and British Columbia) except Alaska, as a result of present or threatened destruction, modification, or curtailment of its habitat or range and introduction of exotic species (Williams et al. 1989). Bull trout have been categorized by some as an indicator species of forest and ecosystem health, since many biologists believe bull trout to be particularly sensitive to environmental change (Mongillo 1993, Rieman and McIntyre 1993).

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have undergone Section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress. Such actions include, but are not limited to previous timber harvests and other land-management activities, including the adoption of a late-successional forest management strategy known as the Northwest Forest Plan (USDA et al. 1994a, 1994b). FEMAT (USDA et al. 1993), the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA 1994a) (FSEIS), the Record of

Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA et al. 1994b) (ROD), and the Biological Opinion on the FSEIS preferred alternative (USDI 1994b) also provide information relevant to addressing the environmental baseline for this action. The Northwest Forest Plan is currently under section 7 consultation with respect to bull trout.

Past land-management activities had degraded habitat conditions throughout the range of many late-successional and aquatic species. The Northwest Forest Plan was developed to address the conservation of a number of species. The basic conservation strategy in the Northwest Forest Plan for riparian areas was designed to protect the natural processes upon which salmonids depend and to address other riparian and upland species.

The Northwest Forest Plan provides for the protection of extensive forest reserves in Federal ownership. A Summary of the Northwest Forest Plan is contained in Appendix 2. The Northwest Forest Plan also placed considerable emphasis on the riparian system.

Riparian Reserves initially comprise 2,627,500 acres, representing 11 percent of the Federal lands within the range of the northern spotted owl (acreage subject to change following watershed analysis). The calculation of riparian reserve acreage is done after all other designated areas. As a result, the acreage shown reflects only that portion of riparian reserves that is interspersed throughout the matrix. Riparian reserves are areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. The main purpose of the reserves is to protect the health of the aquatic system and its dependent species; the reserves also provide incidental benefits to upland species. These reserves will help maintain and restore riparian structures and functions, benefit fish and riparian-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat. The Aquatic Conservation Strategy contains four components: riparian reserves; key watersheds; watershed analysis; and watershed restoration. Each part is expected to play an important role in improving the health of the region's aquatic ecosystems.

Riparian Reserves: designates initial reserve widths for protected riparian areas, as well as specific requirements for timber management, road construction and maintenance, grazing, recreation, minerals management, fire/fuels management, research, and restoration activities. Initial boundary widths (based upon site potential tree heights for trees over 200 years old) for riparian reserves are as follows:

- Fish-bearing streams - the area on each side of the stream equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greater;
- Permanently flowing nonfish-bearing streams - the area on each side of the stream equal to the height of one site-potential tree, or 150 feet slope distance, whichever is greater;

- Lakes and natural ponds - the body of water and the area to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greater;
- Constructed ponds and reservoirs and wetlands greater than one acre - the area from the edge of the wetland or the maximum pool elevation to a distance equal to the height of one site-potential tree, or 150 feet slope distance, whichever is greater;
- Seasonally flowing or intermittent streams -- the area on each side of the stream to a distance equal to the height of one site-potential tree or 100 feet slope distance, whichever is greater;
- Wetlands less than one acre and unstable and potentially unstable areas -the extent of unstable and potentially unstable areas, and wetlands less than one acre to the outer edges of the riparian vegetation. For instance, riparian reserves would include the stream channel and adjacent areas up to the top of the inner gorge when such features are present.

Initial boundary widths of riparian reserves established by this decision will remain in effect until they are modified following watershed analysis. Guidance on boundary modifications are contained in the Northwest Forest Plan Record of Decision standards and guidelines.

Key Watersheds: The Aquatic Conservation Strategy designated three categories of watersheds:

- Tier 1 key watersheds -- those to be managed for at-risk anadromous salmonids, bull trout, and resident fish (141 watersheds, 8,119,400 acres);
- Tier 2 key watersheds -- those where high water quality is important (23 watersheds, 1,001,700 acres); and
- Non-key watersheds -- all other watersheds (15,334,200 acres).

Watershed Analysis: Federal watershed analysis is a systematic procedure to characterize the aquatic, riparian, and terrestrial features within a watershed. Managers will use information gathered during watershed analyses to refine riparian reserve boundaries, prescribe land-management activities including watershed restoration, and develop monitoring programs.

Watershed Restoration: Watershed restoration is designed to restore currently degraded habitat conditions. The most important components are control and restoration of road-related runoff and sediment production, restoration of riparian vegetation, and restoration of in-stream habitat complexity. Restoration programs will initially focus on arresting road-related erosion and silvicultural treatments in riparian reserves to restore large conifer

canopies. In-stream restoration is inherently short-term and will be accompanied by upslope and riparian restoration to achieve long-term watershed restoration.

When the Northwest Forest Plan is implemented as originally designed and intended, and as it may be modified through Section 7 consultation, Federal lands are expected to carry the major burden of conservation and recovery of late-successional habitats and associated species such as the bull trout. The Northwest Forest Plan only covers a portion of the species range. However, other Federal efforts being undertaken in the Interior Columbia River Basin will address bull trout and other species. While contributions from nonfederal land remain important in many areas, proper implementation of the Northwest Forest Plan should allow greater flexibility in the management of these nonfederal lands.

The Northwest Forest Plan will result in most of the National Forest land in the Planning Area being managed for late-successional and old-growth forests characteristics (USDA and USDI 1995). Since landscape-level legacies to fish and wildlife resources cannot be addressed only upon National Forest land, the treatment of nonfederal lands within the checkerboard ownership plays an important role determining success of the Northwest Forest Plan in the Planning Area and upon cumulative effects.

Forest Service lands may provide fairly large patches, especially as time progresses, but would still be limited by natural and human-induced breaks in vegetation patterns and the checkerboard ownerships. Generally, the largest patch that the National Forest could manage, in the absence of land exchange, would be 640 acres. In many cases, nonforested habitat and/or prior harvests reduce old-forest patch size below 640 acres. Land exchanges are likely in the future. Such exchanges would allow the Forest Service to "block-up" its ownership and establish larger patches of older forests as well as establish connective corridors. The HCP would not preclude land exchanges in the future. In addition, forests harvested in the past decades are maturing and during the Permit Period should provide stands of sufficient stature to buffer late-successional forests and reduce or eliminate edge effects between forests and nonforest units.

The ROD for the Northwest Forest Plan (USDA et al. 1994b) recognized the Snoqualmie Pass Adaptive Management Area (SPAMA) as a "*critical connective link in the north-south movement of organisms in the Cascade Range.*" The linkage has two attributes: (1) Provisions of more or less continuous habitat corridors; and (2) the size of habitat patches in and adjacent to corridors. The SPAMA Team (USDA and USDI 1995) observed that "*the distribution and size of forest patches is essential to the intent of the ROD*" to "*maintain a functional, interactive, late-successional and old-growth forest ecosystem.*" With smaller patches of late-successional forest there is more "*edge effect and less effective late-successional habitat due to reduced interior forest.*"

One objective of the Riparian Conservation Areas (RCAs) on Federal land is to establish a system of interconnecting habitat corridors. This strategy fails to accomplish its purpose on some checkerboard lands where only alternate sections will be protected by a stream-side corridor (i.e., RCAs) (USDA and USDI 1995) and nonfederal land is harvested under current State regulations.

Baseline Landscape

As mentioned earlier, the HCP Planning Area lies amongst a considerable amount of Federal land in the Central Cascades. The Alpine Lakes Wilderness is located in the north central portion of the HCP Planning Area and extends to the north and east of the HCP Planning Area. Norse Peak Wilderness is immediately to the south of the HCP Planning Area and just to the north of the William O. Douglas Wilderness. The Clearwater Wilderness is located to the southwest of the HCP Planning Area. Management activities will be virtually absent from these areas in terms of forestry and land management. Impacts will be primarily from dispersed recreation. Wilderness areas are often popular backpacking and horseback riding areas. Isolated locations with particular aesthetic qualities are often used intensively which results in soil compaction, trampling of wetlands, intense grazing, burning of woody debris for firewood, and use of local sources of drinking water by people and horses. In general though, most Wilderness areas will be maintained in a natural condition and will provide habitat for a wide range of species, including late-successional species.

Mt. Rainier National Park is located to the southwest of the HCP Planning Area and is maintained in a relatively pristine condition. Large portions of this area are in high-elevation forests or are nonforested. Campgrounds and trails are found within the Park, but dispersed recreation is more strictly regulated than in most wilderness areas. Tourism (e.g., sight-seeing and photography) and education are the primary activities. The North Cascades National Park is north of the HCP Planning Area, but is too distant to be considered for this analysis.

Late-Successional Reserves are found to the east of the northern portion of the HCP Planning Area in the Teanaway drainage, to the southwest between the Clearwater Wilderness and the Norse Peaks Wilderness, and to the south and east of the HCP Planning Area along with managed late-successional lands. The Snoqualmie Pass Adaptive Management Area (SPAMA) is found within the Planning Area and abuts the Alpine Lakes Wilderness area to the north. These lands will be managed with the objective of creating and maintaining late-successional habitat (USDA and USDI 1995). Matrix lands are found within the southeastern and western portion of the HCP Planning Area, as well as outside and to the south of the central portion of the HCP Planning Area. These National Forest lands, in conjunction with other Federal lands, completely bound the north, south, and northeast of the HCP Planning Area. These lands are expected to be managed in a very conservative manner and are expected (as a result of section 7(a)(1) of the Act) to contribute very little to impacts. Consultation regarding the Northwest Forest Plan and bull trout is currently ongoing.

The Northwest Forest Plan designated approximately 55,256 acres of Federal land as late-successional reserve (LSR) within the HCP Planning Area for the purpose of long-term support of owl habitat and population clusters. About 49,063 acres of LSR occur within the Action Area. Due to the checkerboard ownership of the Action Area, 36,597 acres of Plum Creek ownership are interspersed within these LSRs. There are also 146,449 acres within Adaptive Management Area boundaries (77,485 acres Forest Service, 55,463 acres Plum Creek) and 22,820 acres of Federal Matrix land with about 13,158 acres of Plum Creek lands interspersed. Administratively Withdrawn Areas and Congressionally Reserved Areas form the bulk of the remaining acres of the 159,290 acres

of Federal lands within the Action Area (HCP Table 1).

In the Pacific Northwest, these Federal forests are managed in accordance with the ROD. Details on how the HCP interacts with the adjacent Federal lands can be found in Chapters 1 and 2 of the HCP. Under the Northwest Forest Plan ROD, riparian areas will be managed in accordance with the Aquatic Conservation Strategy, which sets up a system of riparian reserves, key watersheds, watershed analysis, and watershed restoration. The streamside protection within the riparian reserves was described above and is briefly summarized below in slope distance:

- Fishbearing streams - greater of two tree-heights or 300 feet.
- Perennial non fish-bearing streams - greater of one tree-height or 150 feet.
- Seasonal streams - greater of one tree-height or 100- foot buffers are also established for lakes, ponds, and wetlands. Also, management strategies differ depending on whether a watershed is "key" or "non-key" (for more details, see ROD). In general, these riparian areas are expected to mature and become older "functional" forest during the next 50-100 years.

This strategy for riparian management will undoubtedly improve riparian and instream fish habitats on Federal lands, and greatly assist in restoring instream habitat features on the adjacent HCP ownership. Approximately 13 percent of the Action Area is composed of areas not capable of supporting commercial forest and known as "nonforested habitat". These areas consist of rock, ice, lakes, and other such habitats. Remaining forest types (~87% of the action area) have been categorized according to Oliver et al. (1995) and described in HCP Section 2.3. Old Growth is found on about 6 percent of the Action Area; while another 36 percent is in Mature Forest or Managed Old Growth. Dispersal Forest represents 14 percent. Pole Timber and Young Forest are 5 percent and 14 percent, respectively. The Shrub Sapling stage has only 2 percent of the Action Area and the remaining 9 percent is in the Stand Initiation stage. In the Action Area, 42 percent of the lands are in mature forest or older, and 14 percent are dispersal forest. The values are 55 percent and 10 percent within riparian habitat areas, respectively (Tables 5a. and 5b.), for mature forest and older and for dispersal forest. Plum Creek's RHAs account for approximately 7,101 acres of this land and are currently 47 percent mature forest or older and 10 percent dispersal forest.

Road densities in the HCP Planning Area average about 2.7 miles per section, and open road densities average 2.0 miles per section. In general, Plum Creek has slightly higher densities than the Forest Service, and other ownerships have much greater densities (HCP Table 14). Road densities in the I-90 Lakes subunit of the HCP are displayed in HCP Figure 21.

While the Washington State Department of Natural Resources (WDNR) has completed a multi-species HCP across their managed lands within the range of the spotted owl, the WDNR HCP east of the crest only addresses species listed as of January 30, 1997, and does not include a riparian-

Table 5a. Estimated percentage of each structural stage within the Action Area.

Habitat Area	1996		2006		2016		2026		2036		2045	
	PC ¹	HCP ²	PC	HCP	PC	HCP	PC	HCP	PC	HCP	PC	HCP
Non ³	10	13	10	13	10	13	10	13	10	13	10	13
SI	7	9	16	12	16	9	6	4	5	4	4	5
SS	5	2	3	3	3	3	3	2	3	1	1	1
YF	27	14	20	12	17	12	13	7	8	5	6	3
PT	5	5	13	9	23	16	30	21	26	15	19	11
DF	19	14	15	13	14	12	21	17	32	26	42	30
MF	22	26	17	24	12	20	11	20	13	20	13	21
MOG	4	10	4	8	4	8	4	6	3	6	3	7
OG	2	6	2	6	1	7	1	10	2	10	2	10
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100

NOTES:

1 - Percentage of Ownership, Plum Creek

2 - Percentage of all ownerships in the HCP Planning Area

3 Non - Non-Habitat

SI - Stand Initiation

SS - Shrub/Sapling

YF - Young Forest

PT - Pole Timber

DF - Dispersal Forest

MF - Mature Forest

MOG - Managed Old Growth

OG - Old Growth

Table 5b. Estimated percentage of each structural stage for Riparian Habitat Areas within the Action Area.

Habitat Area	1996		2006		2016		2026		2036		2045	
	PC ¹	HCP ²	PC	HCP	PC	HCP	PC	HCP	PC	HCP	PC	HCP
RHA's ³ - Non ⁴	4	15	5	13	5	13	5	13	5	13	5	13
SI	3	8	7	7	2	1	2	1	2	1	2	1
SS	6	1	4	4	1	0	1	0	1	0	0	0
YF	28	7	21	8	6	3	6	3	3	1	2	1
PT	2	3	11	5	22	14	22	14	14	9	8	4
DF	10	10	10	9	20	13	20	13	29	19	33	20
MF	37	32	32	31	30	30	30	30	33	31	34	33
MOG	7	14	8	12	11	8	11	8	11	9	12	9
OG	3	9	3	12	3	18	3	18	3	18	4	19
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100

NOTES:

1 - Percentage of Ownership, Plum Creek

2 - Percentage of all ownerships in the HCP Planning Area

3 - Search area within Riparian Habitat Area

4 Non - Non-Habitat

SI - Stand Initiation

SS - Shrub/Sapling

SS - Shrub/Sapling

YF - Young Forest

PT - Pole Timber

DF - Dispersal Forest

DF - Dispersal Forest

MF - Mature Forest

MOG - Managed Old Growth

OG - Old Growth

OG - Old Growth

protection strategy or a comprehensive road management plan. The WDNR may continue its current policies which direct staff to retain larger buffers along streams and be more protective of natural resources on behalf of their fiduciary trust responsibilities; however, there are no guarantees that these actions would continue.

Status of Various Habitats in the HCP Planning Area

Aquatic habitats have been generally degraded by past activities as well. Fish species, especially anadromous or catadromous species, are also subject to a wide variety of factors outside the HCP Planning Area which are described by Watson and Toth (1995) and summarized in USDC 1996. These factors include degradation and loss of spawning and rearing habitat resulting from many activities including timber harvesting, agriculture, road construction, urban development, water withdrawals; over-exploitation in ocean and freshwater fisheries; and migratory impediments such as dams and water diversions. It should be noted that anadromous salmonids are an important "habitat" factor for many other species. They either serve as predators, prey, sources of nutrients, or provide some other component of other fish species "habitat." It has been speculated that lack of anadromous prey following construction of a dam in western Washington led to the disappearance of bull trout in the upper portion of that watershed.

Past forest practices within the HCP Planning Area have contributed to the current legacy of degraded conditions of instream and riparian habitats. Excessive harvests in the riparian zones, logging of unstable slopes, and inadequate road building have all contributed to this. A pervasive problem found in a recently completed watershed analysis within the HCP Planning Area (Quartz Mountain Watershed Analysis, March 1994) was excessive fine sediment which can negatively impact spawning habitat and reduce the quality of wintering habitat. Other problems identified in portions of the HCP Planning Area include low pool-frequency, low pool-quality, lack of adequate cover, general lack of riparian vegetation, frequent and excessive redd-scour from peak flows, and a low number of stable side-channels.

Perhaps the greatest threat to bull trout involving forest practices and roads stems from the ongoing and latent adverse effects caused by over a century of logging. Latent threats are illustrated by approximately 2,300 land slides correlated with high logging road density on National Forest lands in the Clearwater and Spokane river basins during high runoff event in 1995 and 1996.

Historical Impacts within the HCP Planning Area

Habitat conditions in the HCP Planning Area have been impacted primarily by past forest practices and agricultural activities. Poor road-construction techniques and locations have led to landslides and debris torrents in streams. Timber harvest in riparian areas has reduced large woody debris recruitment that is important for forming complex fish habitat. Additionally, riparian harvest has reduced stream shading and caused increases in water temperature. Even though current forest practices are greatly improved over past practices (i.e., riparian management zones, best management practices), there is still a concern that habitat loss is occurring from latent, chronic sedimentation of streams from old roads and from previously harvested riparian leave areas which provide inadequate

amounts of large woody debris and shading. Regrown riparian stands often begin to contribute "functional" wood within 40 years after harvest, but at an insufficient rate to offset decomposition and loss. Recovery of large wood requires regrowth of stream-side trees to sizes functional in the channel (key piece size) and recruitment of these trees into the channel. This is a long-term process (100-600 years), due to the time required for trees to become established, grow, and be recruited into the channel. Harvest of slopes may cause destabilization as roots decay until the reestablishment of mature conifer stands. About 5-10 times as many landslides occur in clearcuts as occur in mature forest. However, partial harvesting slopes maintains an interlocking root system of mature conifers.

Agricultural activities and associated dam operations are a primary factor responsible for the decline of salmonid species in the Yakima River Subbasin (Watson and Toth 1995). Available habitat for anadromous fish has been greatly reduced by diversion dams for irrigation that prevent upstream migration because of physical barriers and/or from subsequent dewatering of streams. Storage reservoirs in the HCP Planning Area (Keechelus, Kachess, and Cle Elum) store water from late fall through the spring. During this time, water is often not delivered to critical spawning and rearing areas resulting in de-watered redds and loss of side channel over-wintering habitat. In the summer and fall, excessive flows limit low-velocity rearing habitat for juvenile fish.

Numerous other factors outside of habitat modification in the forested portions of the watershed have impacted fish populations in the Yakima River Subbasin. See EIS Section 4.13 for a more complete discussion of the cumulative impacts of human disturbance on fish resources.

Status of the Species (within the action area)

Status and Distribution

The distribution of bull trout in the upper Yakima River Subbasin in the Action Area occurs mainly in the mainstem Yakima River, and in the I-90 Lakes Subunit area and tributary streams north of the lakes (HCP Figure 32). Demonstrating absence of a species in a given area is very difficult. A combination of daytime snorkeling and electro-shocking was used by Plum Creek, according to Hillman and Platts (1993), in an attempt to document the presence/distribution of bull trout. Daytime snorkeling is considered sufficient for determination of presence, whereas nighttime snorkeling is needed for obtaining population or density data. However, daytime snorkeling is generally less efficient and has lower encounter rates with adult and juvenile bull trout, although water temperature may be a factor affecting the efficiency of both snorkeling methods. The strong link of bull trout to the substrate and the purity of water (pure water does not conduct electricity as well rendering electroshocking less effective) in many of these streams contributes to the difficulty of these surveys. Random selection of survey reaches, assumed sampling efficiencies, and minimum encounter densities have also been discussed with regard to the Hillman and Platts methodology (1993). However, this technique has detected bull trout east of the Cascade Crest. Because all perennial streams receive 100-foot RHAs and all fishbearing streams receive 200-foot RHAs, and watershed analysis will be completed throughout the Action Area, nondetection of bull trout is not an issue in the action area.

Within the mid-Columbia River geographic area between the confluence of the Snake River and Chief Joseph Dam, bull trout occur in 16 subpopulations: eight in the Yakima River, three in the Wenatchee River, two in the Entiat River, and four in the Methow River. Historically, bull trout occurred in larger areas of the four tributaries and Columbia River. Bull trout are thought to have been extirpated in 10 streams within the area: Satus Creek, Nile Creek, Orr Creek, Little Wenatchee River, Napeequa River, Lake Chelan, Okanogan River, Eightmile Creek, South Fork, Beaver Creek, and the Hanford reach of the Columbia River. Most bull trout in the mid-Columbia River geographic area are isolated by dams or unsuitable habitat created by water diversions.

Bull trout in the mid-Columbia River area are most abundant in Rimrock Lake of the Yakima River basin and Lake Wenatchee of the Wenatchee River basin. Both subpopulations are considered "strong" and increasing or stable. The remaining 14 subpopulations are relatively low in abundance, exhibit "depressed" or unknown trends, and primarily have a single life-history form. The Service considers 10 of the 16 subpopulations at risk of extirpation because of naturally occurring events due to isolation, single life-history form and spawning area, and low abundance.

Although bull trout in the Yakima River drainage are believed to have historically occurred throughout the drainage, the fish have been nearly eliminated from the mainstem Yakima and several tributaries due to dams, irrigation diversions, thermal barriers and other human-caused habitat changes.

Bull trout are now isolated in eight subpopulations in the Yakima River basin: 1) Ahtanum Creek, 2) Naches River, 3) Rimrock Lake, 4) Bumping Lake, 5) North Fork Teanaway River, 6) Cle Elum Lake, 7) Kachess Lake, and 8) Keechelus Lake. The Service prepared a status review summary for the Klamath and Columbia River population segments.

Storage dams (Tieton, Bumping Lake, Keechelus Lake, Kachess Lake, and Cle Elum Lake dams) now isolate five of eight bull trout subpopulations in the Yakima River basin, with agricultural diversion dams isolating three additional bull trout subpopulations status within the area (WDFW 1997).

Historically, bull trout in the Yakima River basin likely occurred throughout the forested portions of the drainage with a distribution and abundance greater than today. Few bull trout now occur in the upper Yakima River (i.e., generally upstream of Ellensburg, Washington). Most are believed to be migrants originating from Keechelus Lake, Kachess Lake, and Cle Elum Lake (WDFW 1997). No identified spawning sites are accessible to fish in the upper Yakima River, so it is unlikely bull trout reproduce in this area (WDFW 1997).

The Cle Elum Lake subpopulation became isolated by Cle Elum Dam in 1905 (WDFW 1997). The subpopulation is composed primarily of migratory (adfluvial) fish, with few bull trout in recent harvest records. Researchers have captured or observed about 20 individuals in this subpopulation since 1990 (WDFW 1997).

The Kachess Lake subpopulation became isolated by Kachess Lake Dam in 1905 (WDFW 1997). Spawning has been confirmed only in Box Canyon Creek. The number of redds observed annually from 1984 through 1996 averaged 4.5 (range: 0 to 11)(WDFW 1997).

The Keechelus Lake subpopulation is composed of migratory (adfluvial) fish and became isolated by a dam in 1914 (WDFW 1997). Spawning is likely confined to Gold Creek, and redd counts from 1984 through 1996 averaged 14 (range: 2-51)(WDFW 1997). Historically, spawning may have occurred in Rocky Run Creek.

In summary, bull trout are believed to have historically occurred throughout the Yakima River basin, but fish have been essentially eliminated from the mainstream Yakima River and tributaries such as Nile, Orr, and upper Satus Creeks. The Service considers six of eight subpopulations (Ahtanum Creek, Bumping Lake, North Fork Teanaway River, Cle Elum Lake, Kachess Lake, and Keechelus Lake) to be at risk of stochastic extirpation due to their inability to be refounded, single life-history form and spawning area, and low abundance.

Additional details regarding status are available in a Service-prepared status summary for the Klamath and Columbia River population segments (FWS 1998b).

Factors Affecting Species' Environment within the Action Area

Factors limiting the distribution and abundance of salmonid fish in and around the HCP Planning Area were addressed by Watson and Toth (1995) and in the June 10, 1998, Federal Register (63 FR 31647). Factors limiting bull trout populations are complex and in some cases dependent upon the activities occurring within a particular watershed or subbasin. For example, within the Mid-Columbia Basin, agriculture, accessibility, predation and competition by non-native fish, poaching, streamflow, forest management, and physical habitat limit bull trout populations. In contrast, bull trout populations in other areas may be limited primarily by alterations in physical habitat, grazing, hydropower development and operation, loss of salmonid prey-base, and flood-control reservoirs (Mongillo 1993). Throughout all subbasins State-wide, it appears that habitat destruction or modification is the most common factor currently affecting bull trout populations, followed by inadequate streamflow and water quality.

Most, if not all, bull trout subpopulations have been and continue to be negatively impacted by a wide variety of perturbations to the animal themselves as well as to their habitat. These perturbations include forest-management practices, hydropower, agricultural practices, grazing, mining, exotic species interactions, fishing and poaching. Few subpopulations are stable or in the process of recovering.

Adverse impacts to bull trout habitat and subpopulations due to land management practices have been documented throughout the Columbia River Basin (Platts et al. 1993; Rieman and McIntyre 1993; WDW 1992). Bottom et al. (1985); WDF et al. (1993); and Kostow (1995) provide reviews of habitat problems in this region. In general, timber-harvesting and associated road-building occur throughout the region on Federal, State, and private lands. Agriculture is also widespread in lower

portions of river basins, and has resulted in widespread removal of riparian vegetation, rerouting of streams, degradation of streambanks and summer water withdrawals (Kostow 1995). The maintenance of riparian vegetation is essential for controlling stream temperature, providing cover, and protecting against lateral erosion (WDW 1991). Removal of streamside vegetation lowers canopy density (shading) and increases sedimentation. Increases in solar radiation raise stream temperatures thereby negatively impacting spawning, hatching, and rearing survival. Increased sedimentation contributes to the loss of spawning habitat and decreases the diversity of aquatic invertebrates and other food items (Newbold et al. 1980). Thus, for the purposes of this analysis, riparian and aquatic habitats included in the environmental baseline are currently assumed to be at risk or not appropriately functioning.

Current Washington State Forest Practice Rules would apply in managing riparian areas in the Action Area. The current rules allow harvest activities throughout the whole Riparian Management Zone up to the edge of a stream. Impacts of near-stream timber harvest, which negatively affect bull trout, include increased stream-bank erosion, increased stream sedimentation, decreased canopy cover causing increased stream temperatures, and decreased large woody debris recruitment (elements in pool formation and instream cover). The lack of a comprehensive riparian and wetland conservation strategy for the Action Area continues to place east-side bull trout subpopulations at risk from timber and non-timber resource activities.

EFFECTS OF THE PROPOSED ACTION

Introduction to Effects

Bull trout populations have been negatively impacted by past and current forest-management practices across their range, and most populations continue to experience the negative effects from these land-use practices and related activities. Direct mortality occurred in the past from recreational fishing, illegal harvest, and population control. While the HCP riparian and wetland conservation strategies provide greater assurance of meeting bull trout habitat requirements in the future than current Washington State Forest Practices Rules (WFPB 1995), the Service has determined that the riparian and wetland conservation strategies and other HCP prescriptions may still have the potential to adversely affect bull trout in some situations.

Type of Effects

Bull trout are sensitive to environmental disturbance at all life stages. The impacts that are expected to occur with implementation are generally of several types: (1) Changes in riparian habitat that may cause harm by slightly, yet incrementally, reducing spawning, fry emergence, and/or survival of fry and juveniles by subtle interruption of the link between riparian forests and in-channel habitat. These effects are expected to be short-term to persistent in duration and minor in intensity; (2) Changes in sediment and water delivery to the channel network that may impact juveniles, fry, and eggs by increasing sedimentation rates or modifying flow regimes. These impacts are expected to be less frequent and of minor intensity with implementation of the HCP; and (3) Changes to in-stream habitat resulting from road construction or triggering of other events such as mass-wasting which

would result in harm to adults, juveniles, fry, or eggs. Such impacts could be more severe than the first two types. Impacts to in-stream habitat would be infrequent with implementation of the HCP and would be expected to remain fairly localized. However, such impacts could have longer-lasting effects, if they were to occur. Additionally, because bull trout in these areas occur at such low numbers and are isolated, even minor impacts may result in local extirpation.

Effects to Habitat

Though instream habitat and riparian conditions are generally variable, and sometimes degraded, throughout the HCP area, the measures taken in this HCP help to maintain and restore instream and riparian habitat across Plum Creek's ownership. With implementation of the HCP, the amount of aquatic habitat will not likely change; but, the amount of quality habitat and, therefore, the amount of usable habitat should increase. Additionally, more habitat may become available through the removal of passage barriers.

Timber Harvest

Under the terms of the HCP, 200-foot horizontally measured riparian buffers have been placed along all fish bearing streams. These are substantially larger than the average site-potential tree height in the Action Area, where site-potential tree heights range between 80 and 140 feet. These buffers are measured horizontally, and on steep slopes are nearly as wide as the 300-foot FEMAT buffers which are measured on the slope. Watershed analysis buffers are measured beginning on the outer edge of the channel-migration zone or channelized debris-flow zone. However, HCP interim and minimum buffers are measured from the edge of the stream (ordinary high water mark). Plum Creek has committed to use whichever buffer extends the farthest upslope. But the lack of consideration of these dynamic channel processes will detract from the effectiveness of the HCP RHAs in certain situations, such as unanticipated channel movement. In these situations, stream-bank integrity could be compromised as could natural flows and patterns dependent on large woody debris.

These buffers are managed consistent with the conservation objectives for aquatic species, which include growing older and larger trees in the riparian areas. Harvest restrictions in riparian buffers range from moderate (partial-cut) to maximum (no-harvest). The retention of older forest in riparian areas as described in Table 5b (e.g., 50 percent in mature forest or better by 2045; 83 percent in dispersal forest or better by 2045)(61 and 81 percent across all ownerships respectively) together with the commitment to only harvest down to the level of foraging/dispersal (FD) habitat for owls is fundamental for maintaining properly functioning riparian habitat including the recruitment of large woody debris. Further, the single commercial entry and the resulting "feathered" harvest treatments will enhance the potential for large woody debris recruitment.

The HCP allows Plum Creek to harvest to 50 percent of the standing volume in the riparian buffers, but this harvest level will seldom be possible. The Services believe that the requirements for FD habitat require the retention of 65-70 percent of the volume in most cases (where entry is feasible), and that this means retention of over 80 percent of the trees. In many cases, harvest is neither possible nor feasible. Under the HCP, Relative Density (RD) and Quadratic Mean Diameter (QMD)

requirements for FD habitat will result in a higher density stand composed of larger trees. For example, on the east side the QMD requirement is 9 inches and the RD is 33. An RD of 33 is approximately equivalent to 58 percent canopy cover (Hicks and Stabins 1995). If the trees retained are all 9 inches in diameter, the resulting stand will contain 225 trees per acre; if they were all 25 inches in diameter, the resulting stand would contain about 50 trees per acre. Hicks and Stabins (1995) present two histograms of tree species, diameter, and density for dispersal forest stands with QMDs of 9.0 and 10.0 inches, and 2 histograms for stands with QMDs of 18.0 and 20.4 inches. These histograms depict a common occurrence east of the crest where multiple conifer species are present and even stands with QMD of 9 inches, frequently have large trees of various sizes and species. The Services also believe that, compared with no harvest in these stands, these treatments will yield an equal or greater amount of large woody debris, due to the opportunity to use silviculture to grow larger trees faster. However, there may be some removal of large trees, particularly on the outer margins of RHAs which may affect recruitment of large wood in the interim. Pool volumes in a Western Washington study were found to not differ significantly between old growth and buffered streams, but was significantly less in clearcut areas, implying that reduced recruitment of large pieces of wood reduces pool volume.

Plum Creek has committed to a 30-foot, no-harvest zone along fish bearing streams to ensure proper riparian functions of bank stability and stream shading. This zone approximates one rooting-diameter and should help protect bank stability. Plum Creek has committed to harvest in these buffers only when management activities are consistent with the restoration objectives stated in the HCP. This no-harvest buffer would act as added insurance against unforeseen deleterious events and miscalculated experimental management actions which could negatively impact bull trout. Entries into the 30-foot zone are only allowed for restoration purposes. Restoration may involve some short term tradeoffs in exchange for long term habitat improvement. All ground-based equipment are also excluded from this zone.

Under the HCP, the treatment of perennial streams depends on location. In the Action Area perennial non fish-bearing streams (including spatially intermittent streams) receive at least a 100-foot managed buffer at the time of adjacent harvest. A 100-foot buffer is mandatory if an east-side stream meets any of the following criteria: (1) it is upstream of a stream supporting salmon or bull trout; (2) it is upstream of a 303(d) listed stream; (3) it is below 5,000 feet within LSR or AMA; or (4) lies within an area managed for owls or owl dispersal. All identified east-side perennial streams are in one of these categories. The 100-foot buffer is managed similarly to the fishbearing stream buffers described above. Harvests within the buffer retain foraging dispersal habitat for owls as described for fishbearing stream buffers. Some thinning of riparian stands are expected to result in more wind firm trees and prepare the buffer for future adjacent regeneration harvests. A 30-foot equipment exclusion zone is established but harvest within the 30-foot zone is not completely prohibited. The primary concern in designing the ground-equipment exclusion zone was to avoid direct mortality to amphibians and avoid compressing interstitial spaces along the bank, but also considered events or actions that might increase sediment loads and erosion, or promote unstable channel morphology. Bull trout would be highly susceptible to these types of events or actions, due to the close association bull trout have to stream substrate and their sensitivity to fine sediment.

The HCP riparian and wetland conservation strategies provides riparian buffers for perennial streams which should be adequate to provide increased bank stability, input of large woody debris and detritus, beneficial water temperatures, and sediment filtering on these water types. As long as management activities are minimized and mature-forest characteristics are maintained within these riparian management zones, negative impacts to bull trout from management activities inside and outside of the riparian buffers should be reduced. Buffers on seasonal streams with unstable areas should provide sufficient protection against mass-wasting and associated sediment inputs, so as to generally avoid adversely affecting bull trout and their habitat downstream in larger streams and water bodies. The HCP buffers are expected to compliment the Aquatic Conservation Strategy on Federal lands and maintain continuous protection and connectivity across the landscape(USFWS et al. 1996; Figure 3).

Under the HCP, even-aged harvest units must contain an average of 6 snags or snag-recruitment trees per acre. Where harvest units contain ephemeral streams with definable channels, a portion of the leave trees are often aggregated in these areas due to logistical constraints. Plum Creek clusters some leave trees in areas adjacent to many small or seasonal streams and protects streams within inner gorges and similar areas of concern through watershed analysis prescriptions. Additionally, because rotations are long (65-120 years depending on species and site) and selective harvest is used liberally (about 80 percent of east-side harvests are uneven-aged management or partial harvest), fewer ephemeral streams are exposed to the temporary yet harsh conditions of a standard clearcut at any given time than would be observed under standard commercial forestry. The common use of selective harvest in the Action Area as well as the extended rotations provides incidental benefits to many smaller and seasonal streams. Uneven-aged management ensures that stream buffers are not exposed to "hard edges." Chen et al. (1993) documented the effects of varying width buffers when exposed to clearcut edges. Microclimate effects of buffers in association with partial harvest are less than would occur with clearcuts, but is not well studied. Within the warmer and drier Ponderosa pine forest class, a significant portion of the streams are ephemeral; yet, this forest type receives a more-conservative treatment focusing on uneven-aged stands where possible. Extended rotations ensure that only a small portion of the stream network is exposed to these effects at any given time. Harvest units of 42 acres on average throughout the Action Area also reduce the harshness of even-aged management when it is utilized on the east side. During the hottest portions of the summer, many of the seasonal streams go dry or subsurface.

Under the HCP, all stream-typing is verified prior to harvest. Harvests adjacent to 303(d) streams are deferred until completion of Watershed analysis and are depicted in the HCP. All perennial streams upstream of a 303(d) listed water receive the 100-foot buffer.

Large wetlands are also important as many of these contribute to water quality or, if associated with open water, may directly contribute to the maintenance of juvenile fish during portions of the year. The buffers required by Plum Creek's HCP for larger, more-complex wetlands are 2 to 4 times larger than under State regulations. The leave trees will be representative in size and species of pre-harvest tree size. The HCP also incorporates no-equipment zones to protect the wetland edge and maintenance of 30 percent canopy cover for forested wetlands. These factors should contribute to maintenance of water quality, temperature, hydrologic flow, and wetland-associated species.

Yarding

Yarding across fishbearing streams is avoided and limited across other perennial streams. Full-suspension is used unless partial-suspension systems are necessary. The removal of trees from the corridor is minimized. Normal breakage occurs and provides snags and downed material. An objective level for corridors is no more than 15 percent of the stream corridor in or adjacent to each unit. However, yarding corridors may be expanded to 20 percent where site-specific considerations or safety require. The use of yarding corridors is minimized, but in some areas yarding corridors are preferable to additional roads or landing areas. Landing construction can increase sediment input to streams and destabilize slopes.

Road Management

Several watershed analyses completed within the HCP Planning Area (e.g., Quartz Mountain Watershed Analysis) have established sediment targets requiring strict control of road densities and additional sediment monitoring. It is expected that watershed analyses to be completed in the future may have similar requirements as necessary. Sediment budgets are quantitative descriptions of rates of sediment production and transport in a drainage basin that can be used to establish the relative contribution of different delivery mechanisms and to estimate trends in the volume and rate of sediment movement over time. Construction of sediment budgets requires the identification of individual erosional processes and storage sites throughout the basin and quantification of the transport processes that link them together. The area where bull trout are known to occur within the HCP Planning Area will have low open-road densities (target of 1 mile per section). Roads are important contributors to sedimentation and landslides that can degrade instream fish habitat, thus lower road densities should also help benefit anadromous salmonids. Open road densities are limited and total road densities will be addressed across the Action Area by sediment budgets and other facets of watershed analysis. Additionally, provisions for grizzly bears further address the location of roads beyond what is addressed within the riparian strategy. Visual-screening requirements on open roads are expected to serve as further incentive for reduction of open road densities even below the 1-mile-per-section target.

With respect to Roads, the HCP:

- minimizes road-building activities.
- minimizes disturbance of riparian areas.
- minimizes disruption of natural flow patterns.
- restricts side-casting during construction.
- utilizes advanced techniques to minimize erosion.
- identifies potential risks.

- closes or stabilizes roads in conjunction with transportation needs.
- utilizes minimum standards for right-of-way clearing.
- ensures roads cross all streams at right angles.

Roads can be a major source of management-related sedimentation in streams, especially in areas prone to mass-wasting. A small percentage of the road system is often a major source of management-related sedimentation in streams and other impacts to stream habitat. The road-management provisions and watershed analysis process are designed to minimize road construction and activity impacts. Plum Creek will consider road stabilization and abandonment for all inactive roads contributing sediment or posing other risks to aquatic resources, since negative impacts to stream habitat may continue to occur with their presence. Closed roads, while not actively utilized, may still be a source of problems until they are stabilized and abandoned (Cederholm and Reid 1987). Only rarely can roads be built that have no negative impacts on streams (Furniss et al. 1991). Given bull trout's apparent high sensitivity to increased sediments at certain life stages, and the susceptibility of some areas to mass-wasting, areas of new road construction and activity have the potential to adversely affect bull trout in some locations in spite of the HCP provisions. Depending on the site of road construction, riparian buffers may act to sufficiently reduce the negative effects of sediment and erosion that are associated with these roads. Roadside ditches may increase the stream drainage network, contribute to peak flows, and therefore facilitate bed-load movement and harm to eggs, alevins, and fry. Excessive sediment, when it does occur, not only affects bull trout by direct effects (e.g., infiltration of interstitial spaces), but also by indirect effects such as increasing temperatures by reducing channel depth, increasing channel width, and thereby increasing exposure to solar radiation.

Traffic by log-hauling trucks will result in road-surface wear and increased sedimentation. The permit is unlikely to increase log hauling traffic, and in fact road closures will decrease use by the public. Road use during saturated periods would aggravate road wear and sediment delivery, but is addressed by the Road Management Plan.

An indirect beneficial effect of the net decrease in roads within these areas is the decreased accessibility by vehicles to rivers and streams containing bull trout. The potential for decreased harvest pressure and poaching on bull trout populations in these areas is another benefit. Over 25 percent of the known bull trout/Dolly Varden populations in Washington are adversely affected by poaching (Mongillo 1993). Poaching is known to occur in many portions of western Washington (USFWS 1997), and road closures should help deter poaching. Lack of access may deter illegal stocking of non-native fish and other activities which are potentially harmful to bull trout.

This attention to roads and their impacts should reduce negative impacts to bull trout and their habitat by decreasing erosion and sediment loading of streams, although the net effect is unquantifiable.

Watershed Analysis

Watershed analysis examines the potential risks to the resources, such as sediment delivery, and develops prescriptions to reduce the vulnerability of the resources. Plum Creek is and will be completing watershed analysis on an accelerated schedule. Watershed analysis is being conducted in cooperation with the Federal and State agencies and/or Tribal interests. Tribal biologists, hydrologists, geo-morphologists, or similar experts are encouraged to participate. All watersheds in which Plum Creek can initiate watershed analysis and still accommodate the needs of the Native American Tribes will be completed by 2002. It is expected that all HCP watersheds in the action area will be completed by 2002.

Monitoring/Research

Monitoring programs evaluate the need for periodic road maintenance and effectiveness of remedial prescriptions and corrective actions. Under the HCP, monitoring is mandatory and provides a feedback mechanism which, together with the other HCP-required aquatic habitat monitoring, can be used to increase the riparian conservation measures if needed. Monitoring includes stream substrate and morphology, stream temperatures, invertebrate monitoring as indicators of biological integrity, and assessment of fish populations.

While aquatic habitat monitoring is quite robust, it must be recognized that salmonid monitoring was never intended to detect changes in the status of bull trout populations. In fact, salmonid monitoring in Cabin Creek is unlikely to affect bull trout because Cabin Creek is not known to be used by bull trout. Plum Creek will also survey streams to determine whether or not individual streams contain fish to determine the appropriate management prescriptions.

Adaptive Management

The HCP is conservative regarding watershed analysis prescriptions. New prescriptions that exceed HCP provisions would be implemented; however, prescriptions allowing reduced conservation measures would not supplant the HCP provisions. Thus, watershed analysis can only increase the size and improve the quality of the riparian buffers. The Adaptive Management Provisions of the HCP include the establishment of a Cooperative Landscape Adaptive Management Area in the I-90 Lakes Subunit, the general area occupied by bull trout.

The aquatic monitoring strategy will test assumptions made in some of the watershed analysis prescriptions, as well as monitor additional variables. Because these elements form the basis of adaptive management in this HCP, the incorporation of new information and the ability to change management strategy is assured. This flexibility is key to assuring this HCP would improve conditions for anadromous salmonids in the HCP area. Amendments may be suggested as knowledge is acquired regarding aquatic habitat and how to achieve comparable conservation benefit with more efficient and effective prescriptions. The Service would review such amendments and proposals to

ensure conservation benefits would be comparable, impacts to other resources would be minor, and the take level anticipated by this BO would not be exceeded. If it is determined that such a change "may affect" bull trout, the Service would reinitiate consultation.

Chemical Application

Chemicals that are used in conjunction with control of broadleaf vegetation have been shown to be toxic to aquatic fauna, including salmonids (Norris et. al. 1991). There are a number of factors that contribute to the infrequency of herbicide applications within the Action Area. Plum Creek's attention to rapid reforestation, the use of high-quality seedlings and high-quality seedling handling and planting techniques, and use of even-aged management all contribute to low frequency of application. Uneven-aged management and partial harvests do not require as much site preparation and replanting, thereby reducing the need to control vegetative competitors. Uneven-aged and partial harvests increase the cost and decrease the effectiveness of herbicides. There is also decreased vegetative competition at higher elevations. In addition to the low frequency of application, Plum Creek also avoids sensitive areas and does not allow spraying within 100 feet of water bodies or within riparian habitat areas. These steps are expected to reduce the frequency of use and, when use is necessary, the application rate, area, or number of repetitions. It is also believed that avoiding open water bodies will minimize the entry of these chemical agents into the aquatic system.

Enhancement

Anadromous salmonids are present throughout the Yakima drainage, even after severe habitat alterations, blockages to migration, and excessive harvests. Although not mandated by the HCP, Plum Creek may continue to participate in cooperative enhancement and restoration projects in the HCP Planning Area at its own discretion. Much of the restoration expected to occur is "passive" rather than "active" restoration. Both passive and active restoration activities approved by the Service are covered activities.

Many riparian areas are currently dominated by red alder or big leaf maple and contain few conifers. Active restoration may be needed in isolated cases to return the reach to natural levels of large woody debris. Development of mature riparian forest is important for floodwaters; absorbing pollutants from runoff; reducing sediment delivery to streams; providing complexity; supplying shade, nutrients, and large woody debris; providing hydrologic connectivity for seeps, springs, and groundwater upwellings; and providing connectivity to off-channel habitats. In accordance with the road maintenance and abandonment plan, watershed analysis prescriptions would require the removal of any culvert blockages to fish passage. Road closures and abandonment, combined with improved crossings and drainage, ensure unobstructed movement of fish both upstream and downstream.

Protection and enhancement of RHAs, watershed analysis, and resultant improved water quality will ensure that the necessary habitat conditions for bull trout, rainbow/steelhead trout, coho salmon, and chinook salmon are maintained and, in many cases, improved throughout the Yakima River Basin. Salmonids, especially bull trout, may be the most habitat-limited species due to their water-quality and passage requirements; therefore, provisions to address the needs of these salmonids should ensure

adequate habitat quality and quantity for other fish and aquatic species. This fundamental assumption has led the Service to believe that this HCP should maintain or improve habitat for other species of fish as well.

Effects to Bull Trout

When developing the conservation prescriptions of the HCP, it was assumed bull trout were present, and, therefore, the riparian and road-management facets of the HCP were designed accordingly. Specifically, the RHA's on fishbearing streams provide for the growth and development of a properly functioning riparian zone, that will provide over the life of the HCP the following riparian functions - suitable substrates, sufficient shade, bank stability, litter inputs for healthy nutrient supply, and a continual source of large woody debris for instream structural elements important to fish.

Substrate, Sediment, and Channel Morphology

Watershed analysis will continue to identify problem areas and ongoing processes and pathways, and results in prescriptions to minimize sediment inputs due to landslides, minimize the frequency of peak flows associated with timber harvest, assess the condition of fish habitat and riparian stands, and monitor the effects of forest practices on aquatic habitat. Also, in accordance with the road maintenance and abandonment plan, watershed analysis prescriptions reduce road-generated sediment to aquatic resources. Fish need a steady flow of oxygenated water which can be affected by low flows. Sediment inputs can be increased by exposed soil, landings, trails, landslide scars, and roads. Landslide scars and roads can provide chronic sources of sediment. HCP measures maintain and enhance instream habitat by minimizing the production and movement of fine sediment, filtering fine sediment, and by minimizing the introduction of fine sediment into spawning and rearing areas. Road closures and abandonment, combined with improved crossings and drainage, will ensure passage of bedload material downstream, further protecting habitat and stream-bank integrity. It should be noted, however, that improvement will likely take considerable time as effects from roads constructed prior to the HCP are upgraded, as old harvest units with insufficient buffers mature, and as mature buffers slowly begin to contribute large woody debris as a result of mortality. In the meantime, large woody debris which is not being dynamically replaced by recruitment will continue to decay, storage structures and complexities will decrease, and additional sediments will be routed through the system.

Juvenile densities may decrease in local areas where embeddedness of the substrate increases. Because of the strong association with the stream bottom, bull trout can be harmed when sedimentation reduces pool depth, alters substrate, reduces interstitial spaces, and causes channels to braid.

The HCP actions ensure substrates capable of supporting spawning, egg development, and emergence, as well as habitat for fry. Complex structures and stable channel structure equate to habitat for fry and juveniles to seek cover from predators and refuge from peak flows and will enhance reproduction and recruitment into the adult population. Increased spawning and rearing success should result in population increases.

Stream Temperature and Shade

Increases in stream temperatures may cause direct mortality, displacement by avoidance, or increase competition with species more tolerant of warm stream temperatures (MBTSG 1998). Because the RHA strategy for fishbearing streams will provide more than a site-potential tree height managed buffer and, on perennial streams, will provide almost a site-potential tree height (100 feet), the protected RHAs generally provide sufficient shade to address stream temperature concerns. Managed buffers are expected to provide greater than 58 percent canopy cover with additional retention nearest the stream bank. In conjunction with increased occurrence of partial harvesting on east side, buffers should maintain air temperature, protection from wind, and relative humidity which can influence stream temperatures. Uneven-aged management, partial harvests, and small harvest unit sizes (about 42 acres on average), should ameliorate negative effects of canopy openings on the microclimate of riparian areas. The use of research regarding the relationship of stream buffers and other aspects and the effects upon temperature will act as feedback into the adaptive-management process which will further ensure that temperature effects remain minimal. However, where ephemeral streams are occupied by bull trout during some portions of the year but have not been detected by surveys, some exposure to increased temperatures are possible during the spring. During the hottest period of the year, most ephemeral streams are expected to become dry and unusable to bull trout. Yarding corridors and road crossings will increase stream exposure, but are not expected to exceed natural background level of effects significantly for any significant distance of stream. Some heating of subsurface soil water may occur for a period of years following harvest, but more research is needed on this topic, particularly with respect to partial-harvest regimes.

Colder waters are expected to enhance both reproduction and survival. Cold temperatures will allow successful emergence and rearing, and will allow fish to find suitable shelter during low-flows. Natural changes in temperature regime should not interrupt life-history or migration timing.

Large Woody Debris

Effective sizes of large woody debris are determined by channel characteristics. The effective height of a tree is the point where it tapers to a diameter less than the effective (or key) piece diameter. For these reasons, effective buffer widths are often somewhat less than a site-potential tree height. Yet on steep slopes, some recruitment of wood will occur from gravitational forces. RHA width exceeds a site-potential tree height, and in some cases approach two site potential tree heights.

The HCP retains standing and down trees for recruitment of large woody debris in riparian areas, providing a continuous source of large woody debris. Increases in large woody debris due to the RHA's create deeper pools for returning adults and summer-rearing juveniles, more hiding cover for juveniles, more habitat complexity for winter-rearing juveniles, natural levels of nutrient input, function to store excess sediment, and minimize effects to downstream fishbearing waters. Some RHAs will be silviculturally treated enhancing long-term large wood recruitment with corresponding short-term effects to wood supply. This may also be true where the 30-foot zone is entered to remove alder or maple and plant conifers. Alder and maple can serve as large wood in many smaller streams and its removal may have short-term effects on adjacent streams. Because large woody

debris forms pools and stores sediment, it also maintains water levels in small streams during periods of low stream flow (Murphy 1995).

The complexity and benefits derived from large woody debris in the stream will enhance the quality of the habitat for adult bull trout by creating deep pools, and should also benefit young and eggs by storing sediment, creating cover, and sorting gravels, and should therefore increase the carrying capacity, which may in turn result in increased densities and numbers of fish.

Blockages

In accordance with the road maintenance and abandonment plan, watershed analysis prescriptions remove any blockages to fish passage at culverts. This opens and maintain previously unusable, albeit historic, habitat, increasing the amount and connectivity of available habitat which would be expected to provide bull trout with opportunities to feed, breed, shelter, survive, migrate, and explore new habitats; thereby enhancing the connectivity and size of currently isolated populations. Some blockages may continue undetected. Removal of blockages may also contribute to local delivery of sediment to streams. However, some blockages (i.e., dams) are beyond the scope of the Plum Creek HCP and the ability of the Company to address.

Removal of blockages and re-establishment of corridors between habitats would allow bull trout to move between habitats used at different life stages thereby enhancing survival and reproduction. It would also allow pioneering of new or historic habitats and decolonization of local extirpations thereby reducing the effects of localized extirpations on the larger subpopulations. Removal of blockages could cause negative effects by providing access for introduced species into bull trout habitats.

Nutrients

Removal of alder and maple from areas close to streams could decrease the amount of allochthonous (outside of stream) production and nutrient inputs. Replacement of deciduous trees and associated shrubs with conifer needles will alter the amount, timing, and quality of detrital inputs. Returning to natural amounts of streamside vegetation should eventually return nutrient cycling and associated macroinvertebrates to natural levels.

Maintenance of natural cycles and food supplies should correspond with seasonal habitat usage by bull trout. This would be expected to provide a usable food source during juvenile and adult stages assisting with reproduction, recruitment, and survival.

Hydrology

Avoidance of any impact to hydrology is a fundamental goal of the HCP. Wetland buffers, ground-based equipment exclusion areas, and road standards were all designed to maintain the natural hydrologic regime. However, both roads and ground-based equipment have the potential to compact subsurface soils bringing groundwater to the surface where it travels more quickly, gravitates to

collection and transport areas, and is subject to warming. Diffuse shunt of water onto the forest floor on the down-slope sides of roads should help in this regard. However, increases in surface water will potentially translate into increased sediment transport. Watershed analysis will focus on physical and hydrologic threats to aquatic systems, such as increased transport. The 100-foot RHAs on spatially intermittent streams should protect the hyporheic zone, springs, seeps, and upwellings. Seeps and springs are also explicitly protected by HCP provisions. Uneven-aged management and partial harvest should ameliorate any negative effects of timber harvest on subsurface soil/groundwater. More research is needed about the effects of upland forestry on hydrology and subsurface soil water.

Effects from altered hydrology will be minor and infrequent but could result in some harm to bull trout. Some contribution to warming, sedimentation, or exaggerated low and peak flows could potentially result, which could in turn affect young bull trout survival.

Adjustments

Watershed analysis establishes appropriate prescriptions to minimize sediment inputs due to landslides, minimize the frequency of peak flows associated with timber harvest, assess the condition of fish habitat and riparian stands, and monitor the effects of forest practices on aquatic habitat. Also, in accordance with the road maintenance and abandonment plan, watershed analysis prescriptions will reduce road-generated sediment to aquatic resources and remove any culverts blockages to fish passage. The aquatic monitoring strategy will test assumptions made in some of the watershed analysis prescriptions, as well as monitor additional variables. Because these elements form the basis of adaptive management in this HCP, the incorporation of new information and the ability to change management strategy is ensured. This flexibility is key to ensuring this HCP will improve conditions for salmonids in the HCP area.

Should it be discovered that the Service's assessment of the value of these prescription for bull trout was wrong and the impacts to the populations are outweighing the benefits, the adaptive-management provisions will ensure that the necessary changes to maintain bull trout and their ability to find suitable habitats to feed, breed, shelter, and survive will occur.

Effects to Critical Habitat

No critical habitat is currently designated; thus, there are no effects to critical habitat. In the event that critical habitat is designated in the future, the Service will reinitiate section 7 consultation and reassess the impacts at that time.

Summary of Effects

One bull trout stronghold subject to extensive logging and road construction is in the Swan River basin (Watson and Hillman 1997). It is difficult to assess the overall effects of forestry practices on bull trout in parts of the basin because of the complex geomorphology and geology of the drainage (MBTSG 1996). However, the Swan River tributaries also drain large areas of contiguous roadless lands that provide important protected bull trout habitat (63 FR 31647). Complex systems are often

difficult to measure, and it is even more difficult to establish cause-and-effect relationships. Counter-intuitive behavior is a characteristic of complex systems. Effects due to management under the HCP regime may be too subtle to measure.

The HCP seeks to maintain the distribution, diversity, and complexity of various watershed components to ensure the protection of aquatic systems supporting bull trout. One of the primary management objectives within RHAs for aquatic resources is to provide an adequate number of large-diameter conifers to maintain natural functioning of the stream ecosystem. Given the HCP efforts to reduce adverse effects to bull trout from timber harvest and related activities, the Service believes that the application of the HCP is not likely to compromise the continued existence of bull trout. The riparian and wetland conservation strategies are generally expected to result in long-term benefits to bull trout. This plan provides the basic habitat components required by bull trout -- cold, clean water and complex habitats which are connected to each other. These habitat attributes will provide bull trout the ability to survive, reproduce, shelter, and migrate to the extent that the population should be able to increase.

The HCP should provide suitable habitat conditions and maintain the low water temperature necessary to support bull trout via the following means. Actions under the HCP will provide large-woody-debris recruitment into all fishbearing streams by maintaining 200-foot buffers on each fishbearing stream bank in a forest-structural condition suitable at a minimum for foraging and dispersal of spotted owls. Based on site conditions, large-diameter conifers adjacent to those streams are anticipated to result from those buffer prescriptions. Selective harvest when used in RHAs, is expected to accelerate the attainment of large-diameter conifers, but may result in some short-term impacts to woody debris. In addition, a no-harvest 30-foot equipment exclusion zone is adjacent to each stream bank. Perennial non fish-bearing streams are also protected through a variety of mechanisms depending on stream type and location. Road construction and maintenance, and provisions for areas of mass-wasting potential, as addressed by Watershed Analysis, should restrict the amount of sediments moving into streams and should provide sufficient shading to maintain low water-temperatures, thus providing the high water-quality required by bull trout. Implementing prescriptions of the HCP should enhance or maintain high-quality bull trout habitat. The HCP should maintain the value of the habitats, and all their inherent characteristics, for bull trout so that their value will not be substantially diminished. The conservation prescriptions, designed to address habitat and water-quality needs of this species and other salmonids, will provide considerably more conservation benefits than would occur without the HCP.

Previous Conclusion Regarding Effects

In its findings on the 1996 signing of the Implementation Agreement containing provisions to conserve unlisted species (USDC 1996), NMFS stated the HCP would likely result in "increased salmonid productivity resultant from the HCP", and further stated that "Considering the possible cumulative effects to anadromous salmonids, the conservation measures identified in this HCP either minimize, or mitigate these effects to the maximum extent practicable. Habitat for sensitive life stages of anadromous salmonids will be increased by the measures identified in this HCP" (NMFS 1996).

In the Record of Decision (USFWS and NMFS 1996), the Service analyzed the resource impacts with respect to the Trust responsibility it has to the Native American Tribes, and concluded that "The Service shares the Tribes interests in maintaining and increasing harvestable numbers of fish, and firmly believe the conservation measures identified in this HCP will further that objective.....believe the riparian conservation measures in this HCP will increase the quality of riparian and instream fish habitat and thereby increase fish production in the long term". The information examined in this analysis continues to support that conclusion.

Interrelated and Interdependent Effects

Regulations implementing Section 7 of the Act require the Service to consider the effects of activities that are interrelated with and interdependent on the proposed Federal action (50 CFR 402.02). The regulations define interrelated activities as those projects which are part of a larger action and depend upon the larger action for their justification, and interdependent activities as those projects which have no independent utility apart from the action that is under consideration. Both interdependent and interrelated activities are assessed by applying the "but-for test," which asks whether any action and its associated impact would occur "but for" the proposed action.

The actions of timber harvest (with its resulting loss of habitat due to removal, modification, or degradation), road construction (including the degradation of habitat values due to the presence of Service's analysis of roads and the density of roads), and related disturbances have already been considered in the 1996 Biological Opinion. The addition of the Columbia River distinct population segment of bull trout to the permit would not change the interrelated and interdependent actions.

Cumulative Effects

Introduction

Cumulative effects, as defined in 50 CFR 402.02, include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this Section because they will require separate consultation pursuant to Section 7 of the Act.

Cumulative effects analysis addresses the effects of the proposed action and other reasonably foreseeable actions at the regional level. Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The EIS and HCP covered Plum Creek lands (169,177 acres) and a substantial area of adjacent lands owned by the Federal Government (201,800 acres) and others (41,000 acres). Because of the checkerboard pattern of ownership, the EIS and HCP analyzed the impacts of the Alternatives for the entire Planning Area (418,690 acres) over the Permit Period. The analysis addresses management

(harvest) activities for each alternative, and for each landowner over the Permit Period, regardless of ownership. Plum Creek provides RHAs in its HCP which complement the RCAs. Other private and State ownerships are assumed to provide smaller, more-intensively managed buffers which may result in additional impacts such as a dearth of large woody debris, excessive water temperatures, and increased amounts of siltation. Even though other HCPs have, or will likely, propose stream-side protection measures that complement the Federal RCAs resulting in a region-wide system of stream-side corridors in the foreseeable future those actions were not assumed in the HCP. Therefore, such actions would only improve conditions above the level assumed in this opinion. Thus, the EIS and HCP analysis, far from being a narrow and short-term analysis, is an inclusive, long-term analysis and by its design addresses cumulative effects for habitats, species of concern, and other aspects of the human environment.

In addition to the HCP Planning Area, activities likely to take place on surrounding lands were analyzed, in a general sense, for cumulative impacts. Many of the areas discussed are depicted in Figures 1 and 2 of the EIS. In order to assess the cumulative effects of actions occurring on nearby and adjacent lands during the term of the proposed Plum Creek HCP several broad assumptions were made. For Federal lands, these are explained in Section 2.6.5 of the HCP. Assumptions regarding other nonfederal ownerships were that standard nonfederal forest management consistent with applicable Federal regulations (e.g., Clean Water Act and Endangered Species Act) and State forest practice rules would continue. This assumption was made in spite of the fact that several HCPs are currently in development by other nonfederal landowners. Those HCPs were too preliminary to make detailed assumptions with confidence, but should be better for wildlife, including owls, than the assumptions which were made about State and Federal regulatory minimums. In order to place the increment of the Plum Creek HCP actions and other anticipated nonfederal actions in perspective of the landscape and overall level of effects and benefits, the following discussion is provided.

Anticipated Actions on Landscape

Agriculture Areas

Agricultural areas to the east of the Planning Area in the Yakima Valley also contribute to the cumulative impacts. One of the primary impacts is the demand placed upon the water supply. Diversions are made from streams to provide for irrigation. Some streams are temporarily dewatered during critical periods. Reservoirs are reduced to extremely low levels where the edge of the water is often far removed from the nearest vegetation. Reservoirs do not contain conservation pools, but are subject to near complete draining. Rimrock Lake has also been subject to drastic drawdowns, but maintains a healthy bull trout population. Reservoir expansions to increase storage capacities are being considered, as are additional reservoirs. These measures would result in loss of terrestrial habitat and further modification of aquatic habitats. Additional instream structures may also prevent fish passage. Many of these factors are addressed in the limiting factors analysis (Toth 1995). These may be some of the most severe cumulative impacts to bull trout. One might assume if it were not for the three dams on the Cle Elum, Kachees, and Keechelus Reservoirs, the three subpopulations in the Action Area would likely be connected and far more numerous than they are at present. However, because the lakes were originally created by terminal moraines, it is not clear if

connectivity for bull trout has existed in recent geologic time. Also, the relationship to drawdowns and the low population level are uncertain, especially in light of the situation at Rimrock Lake and the relatively pristine conditions that exist in Gold Creek and Box Canyon, upstream of Keechelus and Kachees Lakes, respectively.

Recreation

The demands for winter recreation may impact almost any lands in the HCP Planning Area, as well as the surrounding areas, that are open to public use. This impact will be mainly along roads and trails. However, such activity is concentrated around Snoqualmie Pass, existing ski areas, and several snow park areas. While some of these actions may be subject to section 7 consultation should they occur on Federal lands, others would not be. These areas may either expand or contract during the Permit Period. One potential expansion might include a destination resort in the Gold Creek/Snoqualmie Pass area. Another potential resort may be developed along the Cle Elum River by Jen-Weld. The unused Milwaukee Railroad line has been converted into a series of hiking trails. Most recreation may be focused along roads or established trails. Dispersed recreation may also have impacts in all four seasons of the year. It is expected that impacts from backpacking, hunting and fishing, and other nonmotorized forms of recreation will have minimal impacts. Motorized recreation in aquatic and riparian areas, as well as concentrated and repeated nonmotorized use of local areas along stream banks will degrade habitat and result in impacts to bull trout.

Non-forest Lands

The County Planning efforts in each County have identified lands which are unlikely to be managed for forestry in the foreseeable future. These include an area from Cle Elum to the south end of Kachees Lake excluded from the HCP Planning Area and, to a lesser degree, an area in the Snoqualmie Drainage near the town of North Bend (EIS Figure 1). These areas, which are not likely to be managed exclusively for timber production in the near future, may be subject to activities such as housing developments, commercial activities, and recreational developments. These activities will have greater impacts on many aspects of the human environment and wildlife than would have occurred as a result of forestry. Such development through the removal of riparian vegetation and creation of impermeable surfaces are expected to increase peak flows and decrease quality of instream habitat along with potential creations of barriers to bull trout.

Urbanization can create a more lasting effect on streams than timber harvest activities due to the severity and permanence of the impacts. The increase in impervious surfaces in conjunction with non-point source pollution associated with development will drastically alter water quality and quantity of urban streams. Other effects of this development may include greater demands on the municipal water supplies, intensive recreational activity, and increased traffic. Additional nontimber activities include valuable-materials extraction, oil and gas exploration, grazing, urban and rural development, recreational site construction and use, grazing, powerlines and pipelines. Riparian degradation, aquatic degradation, and expanded road construction and use resulting from these nontimber resource activities are impacts with potential to adversely impact bull trout.

Forestry

Both King and Kittitas Counties have identified areas through their County Planning Process (see Land Use -- EIS Section 3.2) that are expected to be managed as forests for the foreseeable future. It is assumed that current management would continue on these lands. The L.T. Murray Wildlife Management Area is managed by the Washington Department of Fish and Wildlife (WDFW) as wildlife habitat. The timber rights are privately owned and harvest could occur along with other associated activities. The WDFW manages the area primarily for the benefit of wildlife.

Boise-Cascade owns timber lands in the Teanaway Drainage. These lands have been managed over many years. Historically, uneven-aged or selective-harvest have comprised the majority of their harvests. These practices are expected to continue. In the central portion of the Planning Area, south of I-90 and Kachess Lake, Plum Creek lands are intermixed with other ownerships, including WDNR, Boise-Cascade, and small private ownerships practicing various levels of forestry.

The Washington Department of Natural Resources (WDNR) owns several sections and partial sections within and adjacent to the Planning Area. Their harvests may be governed by the WDNR HCP and internal policies. While forestry management may be more conservative than in the past, timber harvest will be comparable to some other areas within the Planning Area. Under the HCP for WDNR, most WDNR parcels within the Plum Creek HCP Planning Area either serve a dispersal or a nesting, roosting, foraging habitat role for owls. Riparian buffers are not part of the HCP and are assumed to follow State forest practices; however, longer relations and/or deferrals for nesting and dispersal of owls will reduce impacts to riparian areas.

The forestry-oriented lands, in conjunction with the municipal watersheds, State wildlife areas, and Federal lands, surround most of the Planning Area with the exceptions noted. Forest activities, if properly conducted, have temporary impacts because stands return to a forested condition, allow natural processes to continue, form no permanent barriers to wildlife, and are less severe than many other development activities. The Yakima Resource Management Cooperative is a voluntary organization of Federal and State agencies, private landowners, Tribes, and environmental organizations on the east side of the HCP Planning Area which strives to achieve landscape goals through cooperative processes. This effort will likely continue and will likely be effective at identifying and minimizing many cumulative impacts. Also, lands east of the Cascade crest are more amenable to uneven-aged management, thereby further reducing the impacts from forestry operations.

The most relevant of these effects are problems associated with current Washington State Forest Practice Rules that continue to place bull trout at risk from timber harvest and related activities. The most significant harvest impacts are likely to occur to Type 4 and Type 5 Waters (non-fishbearing headwater streams, perennial and seasonal) which receive no protection or minimal protection under State regulations. These impacts would likely affect water quality and quantity in certain watersheds. In spite of the efforts of these land-managers, in the absence of conservation at or near the level provided by the HCP, increases in sedimentation and stream temperatures are likely to occur as well as changes in seasonal flow-regimes (i.e. increases in winter peak flows and decrease of summer low flows). Due to the high sensitivity of bull trout to fine sediments and elevated stream temperatures, these habitat changes are likely to have adverse cumulative impacts on bull trout. The effects of these

localized impacts would not be restricted to Type 5 Waters (seasonal and intermittent streams), but would be translated downstream to larger water types. Similar impacts would also occur directly to Type 1 through Type 4 Waters (perennial), affecting water quality and quantity in certain watersheds. In addition, there is potential that many localized habitat changes (impacts) might occur simultaneously at different locales, or in the same locales at different times. Some of these changes may further exacerbate existing degraded habitat conditions in some areas, or could further fragment bull trout habitats and contribute to bull trout declines.

Riparian Management Zone widths, as specified by the Washington State Forest Practices Rules, would not always ensure protection of the riparian components because the minimum widths are insufficient to fully protect riparian ecosystems (USDI et al. 1996). In most cases, current practices are not sufficient to address salmonid habitat needs (detrital inputs, water temperature, stream bank stability, large woody debris recruitment). Current Washington State Forest Practices Rules allow harvest activities throughout the whole Riparian Management Zone up to the edge of a stream. This allowance poses a substantial risk to bull trout because it greatly hinders proper riparian function. Impacts of near stream harvest, which will negatively affect bull trout, include increased stream-bank erosion, increased stream sedimentation, decreased canopy cover causing increased stream temperatures, and decreased large woody debris recruitment impacting pool formation, instream cover, and sediment storage in smaller streams. Through the Washington Timber, Fish, and Wildlife Group, discussions are ongoing between Federal and State agencies, Tribes, Environmental groups, representatives of industrial timber companies, and nonindustrial tree farmers. Upon listing the bull trout, streams known to contain bull trout, or deliver into streams containing bull trout, may receive additional consideration, similar to those currently provided to listed steelhead stocks.

Increases in road construction and activity associated with timber harvest will likely adversely affect bull trout populations. Another problem is the lack of comprehensive road-network management planning, that would have the potential to strongly minimize active road densities through landscape planning and increased closure and abandonment for inactive roads. Additional roads developed without landscape planning would merely exacerbate the current problems of high sedimentation and erosion associated with forest-road networks, which adversely affect aquatic habitats and their inhabitants. Given bull trout's apparent high sensitivity to fine sediments at certain life stages, and their strong association with pool habitat, any new road construction and activity which causes sediment loading of nearby streams will adversely affect bull trout residing in these particular locations. The application of chemicals to control broadleaf vegetation can also reduce the canopy of vegetation in riparian corridors, as well as increase the possibility of direct input of chemicals into streams. Fuels treatment such as broadcast burning is no longer common, but can increase surface erosion by increasing surface runoff when such burning is used. Pile burning is expected to have far less effect.

Stochastic Events

With regard to cumulative effects, the major biological issue is the loss of older functional forests and the effect of this loss on the decline in health of the aquatic systems and the surrounding riparian areas upon which they depend. Two aspects of forest-health have major implications for cumulative impact. Both fire risk and the potential for insect damage increase during the Permit Period in the

HCP Planning Area (HCP Figures 49-54). Both of these factors increase because of the maturation of the forests and current fire-protection measures have had on stand density and species composition. This trend within the HCP Planning Area is shared with other areas, especially east of the Cascade crest, where forests are accumulating fuels. Thus, in the absence of any change in management direction, forests in the HCP Planning Area, (and therefore HCP lands and National Forests, too) can be expected to have increasing risks of catastrophic fire and/or insect damage.

Wildfire has played a major role in shaping the forests in both the eastern and western Cascades Region. Recent efforts at fire suppression, especially in the eastern Cascades, and selective timber harvesting practices have resulted in shifts in tree species composition in some areas. Certain forests in the region are more susceptible to catastrophic fires and epidemic attacks of insects and disease.

Fisheries Management

Currently, several agencies and groups are involved in active efforts to increase both resident and anadromous species in the Yakima River. These efforts are focused at both hatchery-released fish and naturally produced offspring through programs that include supplementation, habitat improvement, and passage-improvement facilities. Figure 1 shows the Yakima River Subbasin including tributaries and the location of major dams. Cooperative efforts such as the restoration project along the Cle Elum River conducted in partnership with the Yakama Indian Nation are expected to continue on a site-by-site basis. In addition, other land-managers are expected to conduct surveys for fish which may prove disruptive to bull trout. Angling activity targeted at other fish species may also have some negative effect on bull trout.

Cumulative Effects to Bull Trout

This analysis focuses on the interaction of the HCP and the other effects likely to occur on this landscape in order to determine if the HCP is contributing to negative cumulative effects for bull trout.

Stand-structural classes were analyzed for each decade. The HCP should not result in any major change in late-successional and old-growth forests in the HCP Planning Area over the Permit Period. This apparent stability is due to combinations of non-declining old-growth on National Forest and Plum Creek lands, as well as maturation of forests on National Forest and Plum Creek land. Furthermore, approximately 60 percent of Plum Creek land is either non-habitat, non-forested, or in early-successional stages that would not become harvestable before the end of the Permit Period. Of the 69,149 acres of owl habitat (nesting, roosting, and foraging/dispersal) in the HCP Planning Area, 18,100 acres (26 percent) are restricted, the remaining acres are unrestricted. Only 4 percent of the 418,690 acre Planning Area was relieved from restrictions under this HCP. The number of restricted acres would have further decreased in the absence of the HCP with the recent decertification of several owl sites. With respect to riparian issues, the HCP sets a higher standard than would otherwise have been required, so there is a cumulative benefit.

The HCP would implement Plum Creek's Environmental Principles, watershed analysis, establish Riparian Habitat Areas and other HCP prescriptions, and implement Best Management Practices for roads in general and their impacts on aquatic resources, habitat protection, and improvement (including road closures). Thus, the HCP would enhance habitat conditions for bull trout. These measures combined with other regional efforts would have beneficial cumulative effects for bull trout. Beneficial Best Management Practices would include protection and provision of special habitat features important to hydrology and water supply such as, wet meadows, wetlands, small streams, and larger riparian areas. It would also include actions such as limiting access in areas sensitive to bull trout impacts.

The HCP, in conjunction with State and private actions expected to occur, would not cause any significant adverse cumulative effects on bull trout populations in the vicinity of the Planning Area or on regional population viability. Intense or concentrated recreation will impact some areas within the Planning area. Dispersed recreation can also be a source of disturbance and conflict which may lead to direct mortality of bull trout in some cases. High road densities on adjacent lands and the private and State lands interspersed within the Planning Area are likely to impact bull trout in those areas should bull trout pioneer or become established in those areas. Conditions to the north of I-90 within the Planning Area are more favorable in general to bull trout survival. The area north of I-90 is primarily managed by Plum Creek and the Forest Service. The Northwest Forest Plan will establish riparian conservation areas along streams, thus leading to a system of riparian corridors. Plum Creek's RHAs will complement the riparian conservation areas on Federal lands.

Because the majority of the ownership within the HCP Planning Area itself is National Forest and Plum Creek, it is expected that cumulative benefits will accrue and that they will provide habitat for spawning and for other life-history requirements. Because of the complexities involved in the life-history characteristics of bull trout, and the considerable variation among subpopulations, it may be difficult to isolate and estimate how and the extent to which particular activities in a watershed may impact bull trout spawning and rearing in the Yakima River Subbasin. For instance, it is unclear what factors influence the structure of the stream fish assemblages or how strong the causal link is between habitat type and availability and population size/viability.

Cumulative effects should be assessed on the level of individual stocks, subpopulations, and the distinct population segment for bull trout. The species range in the Columbia River distinct population segment (141 subpopulations in the Columbia River DPS) extends well beyond the action area into Idaho, Oregon, and Montana, and therefore not all subpopulations are affected by the action. Subpopulations that will be affected by the HCP are those residing in Cascade Mountain drainages in Washington. These three subpopulations are isolated, at the western-most portion of the distinct population segment, and are geographically and genetically disconnected from the majority of the distinct population segment residing in Rocky Mountain drainages. Further, not all of the subpopulations associated with Cascade Mountain drainages will be affected. However, given the isolation and current status of these three subpopulations, additional cumulative effects could be severe.

Further, although all subpopulations of the distinct population segment are important, given the depressed and fragmented nature of this population segment, from a recovery perspective the most important subpopulations are those with 1) the largest number of individuals; 2) the largest amount of functional habitat; 3) the largest number of subpopulations that could conceivably contribute toward genetic variability; 4) the largest amount of habitat with potential for repopulation; and 5) related to three and four, the subpopulations with the greatest potential for reconnectedness. Furthermore, those subpopulations that comprise the majority of the distinct population segment in the Rocky Mountain drainages reflect the above criteria and represent the majority of the recovery potential for this distinct population segment. Nevertheless, bull trout within the action area are expected to benefit from this action and are important. There are currently few subpopulations in the Yakima River Basin that are not at risk of stochastic extirpation.

CONCLUSION

After reviewing the current status of the Columbia River distinct population segment of the bull trout; the environmental baseline for the action area; the effects of the proposed plan; and the cumulative effects; it is the Service's biological opinion that continued implementation of the HCP and the inclusion of the Columbia River distinct population segment of bull trout on the Incidental Take Permit are not likely to jeopardize the continued existence of the aforementioned species. Critical habitat for the bull trout has not been designated at this time; therefore, it will not be affected. The timber-harvest activities are expected to adversely affect the bull trout; and incidental take of individual bull trout is likely to occur within acceptable levels.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act, as amended, prohibits taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. *Harm in the definition of "take" in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Harass in the definition of "take" in the Act means an intentional or negligent act, or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.* Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

This incidental take statement applies only to Columbia River distinct population segment of the bull trout. The owl, murrelet, grizzly, and wolf were previously addressed in the June 24, 1996, Biological Opinion. Should Plum Creek request that bald eagles, peregrine falcons, or any of the currently unlisted species be added to the permit, formal consultation under Section 7 of the Act will

be reinitiated, at which time a definitive incidental take statement would be issued for the species, provided the proposed action is in compliance with Section 7(a)(2) of the Act.

The measures described below are non-discretionary, and must be implemented by the Service so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in Section 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service: (1) Fails to require the permittee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) Fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse.

AMOUNT OR EXTENT OF TAKE

The Service expects that this action is likely to result in incidental take of bull trout in the form of harm or harassment due to effects from timber harvest and related activities, including road building, stream crossings, canopy removal, and potential increases in sediments and temperature which may adversely impact bull trout at a number of life-history stages. The proposed Service action of adding bull trout to the subject permit is contingent upon the implementation of the conservation measures in the HCP and as such they are part of the proposed action. Estimates of incidental take account for the operation of these conservation measures. Because of the inherent biological characteristics of bull trout, the likelihood of discovering an individual death or injury attributable to this action is very small.

The Service anticipates that impacts to bull trout will be difficult to detect at the individual organism level for the following reason(s): (1) Bull trout are wide-ranging and are affected by factors beyond the control of Plum Creek; (2) Juveniles, fry, and eggs have small body size and are, therefore, difficult to detect when alive; (3) Finding dead or impaired specimens is unlikely, especially considering the often small body size of eggs and fry, denseness of vegetation/substrate, and remoteness of the area; (4) Losses may be masked by seasonal fluctuations in numbers or other causes; (5) Dead or impaired specimens may be washed downstream of the site where the impact occurred; (6) Dead or impaired specimens may be consumed by other fish and wildlife species; and, (7) There is a large area with many stream miles to monitor. However, habitat conditions may be used as a surrogate preliminary indicator of take or impact. This assessment focused on the amounts and quality of habitats provided/impacted for the Columbia River Basin distinct population segment.

Therefore, even though the Service expects incidental take to occur from the effects of the action, the best scientific and commercial data available are not sufficient to enable the Service to estimate a specific number of individuals incidentally taken based on loss or injury of individuals of the species. For instance, if the bull trout population were to increase during the permit period, a larger number of individuals may become subject to some level of take. Conversely, if bull trout were to decrease, less take might occur. Consequently, take is estimated based on the quantity of habitat likely to be impacted in the 50- to 100-year period. In some cases, this impact may adversely affect bull trout sufficiently to result in harm or harassment.

Selective harvest in RHAs is expected to occur at any given location only a maximum of once per 50 years. Because harvest in many older riparian stands is limited by the relative-density requirement, removal of an extremely small percentage of the volume, or any harvest, is not always feasible. Additionally, landscape-level targets must be reached for riparian areas. For these reasons, the Service expects only about 1 percent of riparian stands to be entered per year at a maximum. Due to the checkerboard pattern of the planning area, less than 0.5 percent of the landscape's riparian areas would be entered per year. Although there may be some occasions when entries result in impacts to additional stream mileage downstream, only a small percentage of these entries would result in impacts that could be construed as take.

The Service anticipates the incidental take in the form of harm of bull trout associated with the selective harvest of about 75 acres of riparian habitat along perennial streams per year; restoration activities (e.g., culvert replacement, hardwoods conversion) along 1 to 2 miles of stream per year (up to 50 acres); and thinning or restoration-oriented silviculture along 75 acres of riparian habitat per year. The Service estimates that of the riparian areas entered each per year, some percent will be in yarding corridors. We expect yarding corridors will be necessary on a portion of those entries (about 75 percent) and that 15 percent of the riparian area associated with those entries would be removed to create the corridors each year. This would result in less than 10 acres of riparian area being removed for yarding corridors. Construction and maintenance of roads are anticipated to adversely impact bull trout sufficiently to result in harm or harassment, particularly during the early life-history stages. The Service anticipates incidental take in the form of harm of bull trout associated with the construction and maintenance of 0.2 miles of roads per year, as a result of implementing the HCP. We also anticipate some incidental take in the form of harm associated with upgrading or removing 20 miles of road per year.

The rationale for the above estimates is similar to the rationale for several species in the June 24, 1996, Biological Opinion. Take is expected to be avoided; but, if it occurs, only a minimal number of individuals would be affected. Bull trout occur in limited areas, especially during early life stages; and, should impacts sufficient to result in take occur, it would be rare and localized. Therefore, the number of individuals likely to be subject to disturbance at any one time, individuals which may be taken, is low, yet unquantifiable. Estimates of take are in terms of amount of habitat impacted to the extent that take could possibly occur.

EFFECT OF THE TAKE

In the accompanying Biological Opinion, the Service determined (for the following reasons) that this level of anticipated take is not likely to result in jeopardy to these species or the destruction or adverse modification of critical habitat.

Take in the form of harm and harassment may occur. Unknown or known redds may be subject to timber-harvest impacts during the incubation period, or young may be subject to impacts during the subsequent rearing period. Individuals may be subject to impacts which may inhibit their ability to survive and reproduce. However, sufficient amounts and quality of habitat are expected to be present to provide bull trout with an opportunity to maintain and increase their numbers within the Action Area.

It is the Service's opinion that minor impacts to a small amount of habitat across the landscape, in association with the potential increase in habitat quality and potentially subsequent numbers of individuals within the Action Area, is within acceptable levels. This corresponds to a small percentage of the bull trout found within the range of the species and within the distinct population segment. Further, any take of individuals that may occur as a result of the proposed action would only affect about 2 percent of the subpopulations in the distinct population segment (3 of 141). The effects will be minimal, because of the conservation measures. However, these minimal effects cannot be precisely defined. The proposed action will only affect a small percent of the population as a worst-case scenario.

Several factors indicate that the HCP is not likely to jeopardize the continuing existence of the distinct population segment ("species"). First, these lands contain only limited segments of bull trout stocks and the species range extends well beyond the HCP Planning Area. Second, the Services maintain the ability to require additional mitigation in the event of a substantial and material decline in the status of the species caused by the HCP. The Service may also terminate the permit as provided in regulations and the Implementation Agreement. Lastly, the Service believes that the HCP is generally expected to result in long-term benefits to bull trout. If fully and properly implemented, the HCP provides riparian and wetland-conservation strategies and road-management provisions which play an important role in the long-term protection of bull trout on Plum Creek lands.

For the reasons stated in this assessment, implementation of the HCP should adequately address bull trout by providing for their continued existence at viable levels and with sufficient distribution, and would contribute to the recovery of the species/distinct population segment.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures, contained within the June 24, 1996, Biological Opinion, remain necessary and appropriate to minimize take of bull trout:

1. Any incidental take of (species) must comply with all the terms and conditions of the Section 10(a)(1)(B) permit (including the provisions of the Implementing Agreement and the HCP) to ensure that conservation measures included to protect the various species are properly implemented.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the Act, the Service must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions, also contained in the June 24, 1996, Biological Opinion, are nondiscretionary.

1. A Section 10(a)(1)(B) permit, as evaluated in this Biological Opinion, must be issued by the Fish and Wildlife Service. The Implementing Agreement for the Habitat Conservation Plan for the Section 10(a)(1)(B) permit must be agreed to by the Fish and Wildlife Service and the permit conditioned upon implementation of the Habitat

Conservation Plan and the Implementing Agreement.

2. The Service has provided a protocol for the handling of dead, injured or ill listed species for pesticide analysis. When the Service suspects a species has been taken in violation of label restrictions, the incident(s) shall be reported to the Division of Law Enforcement or their designee in the Region in which the species is found. Instructions for proper handling and disposition of such specimens will be issued by the Division of Law Enforcement: Assistant Regional Director; Division of Law Enforcement; 911 N.E. 11th Avenue; Portland, Oregon 97232-4181; (503) 231-6125
3. The Service shall amend permit condition (H) to read as follows: *The permittee will notify the Service if locations of nesting murrelets not described in the HCP are discovered, if additional owl site centers not described in the HCP are discovered, if additional stream reaches are found to contain bull trout, or if any observations of wolves or grizzly bears are made within the HCP Planning Area during the course of the HCP.*

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service offered the following conservation recommendations in the June 24, 1996, Biological Opinion, of which recommendations 1 through 4, and 6 remain applicable to bull trout:

1. The Service should provide technical assistance to Plum Creek throughout the term of the permit.
2. The Service should provide technical advice on monitoring and other biological issues associated with implementation of the HCP.
3. The Service should conduct regular compliance monitoring and review the periodic reports.
4. The Service should assist Plum Creek in coordinating with surrounding landowners, particularly the U.S. Forest Service.
5. When the Service is notified that an area that may be suitable for use by bald eagles for communal night roosting may be subject to harvest, the Service should survey that area for bald eagle use prior to harvesting. Surveys should be carried out when bald eagles would be expected to use the area. The bald eagle wintering activity period extends from October 31 through March 31.

6. The Service should review progress made by Plum Creek and provide advice regarding updates and improvements to inventory data, including understory composition, downed woody debris, snags, and standing defective trees; and corresponding updates to the stand structure and composition data.
7. At the time of proposed listing, the Services should solicit public and scientific comment on the addition of that species to applicable incidental take permits which include unlisted species agreements in the Federal Register notice of proposed listing.

In order to document actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service shall provide, in writing, reports of the implementation of any conservation recommendations at the time of the periodic reporting. The variances from the recommendations may be reported instead.

For instance, the proposed rule for listing the Columbia River distinct population segment of bull trout did not solicit public comment and scientific information pertinent to the action of adding bull trout to permits associated with unlisted species agreements. However, the Service did publish a separate notice with regard to this action of adding the Columbia River distinct population segment of bull trout to the subject permit in order to solicit such information from the public.

With respect to bull trout, the Service offers the following additional conservation recommendation:

8. The Service should encourage the development of Habitat Conservation Plans and other similar conservation efforts on State, Tribal, and private lands within the range of the bull trout, which will allow for increased conservation benefits that tie directly to efforts on Federal lands in providing a comprehensive management strategy to conserve bull trout populations. Conservation activities will be necessary to improve the connectivity between populations, and to restore habitat within population areas.
9. The Service should encourage the implementation of adequate riparian buffers on State, Tribal, and private lands for any type of stream that has the potential to impact bull trout, but particularly the ephemeral or intermittent streams that may deliver water, sediment, and wood to bull trout streams, for which protection under Washington Forest Practice Rules in their current state are particularly inadequate for the protection and restoration of bull trout.
10. The Service should encourage development and implementation of a comprehensive road-network management plan on State, Tribal, and private lands. Generally, bull trout thrive in landscapes where impacts from roads are minor. Roads within riparian areas, roads with chronic sediment problems, and roads that are likely to fail should be upgraded, relocated, or removed.
11. The Service should encourage and seek opportunities to implement habitat-restoration efforts on those State, Tribal, and private lands that have already been negatively impacted from timber-harvest activities or other habitat-degrading actions.

Restoration activities such as decommissioning roads, removing impassible culverts, stabilizing areas prone to erosion, and replanting of riparian areas, will help restore degraded bull trout habitat. Although preventing habitat degradation is easier and less-costly than restoring habitat after it has been impacted, the Service should still seek future opportunities on those State, Tribal, and private lands that may have been degraded in the past and offer opportunities for improvement, in conjunction with State, Tribal, and private partners and cooperators.

12. The Service should ensure that the status and trend of the small, isolated stocks of bull trout within the action area are monitored.
13. The Service should incorporate channel-migration zones and channelized debris-flow zones into its consideration during HCP negotiation and development. This concept should also be incorporated whenever adjustments are made to riparian strategies as part of adaptive management or as suggested amendments by the permittee.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) A new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Item 2 above, regarding new information, could include deviations from the Northwest Forest Plan. Should such deviations occur to the extent that the baseline is significantly altered or the integrity of the HCP and its assumptions are compromised, consultation would be reinitiated.

If you have any questions regarding this biological opinion, please contact William Vogel of my staff at (360) 753-4367 or the letterhead phone/address.

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APPENDIX 1

CHRONOLOGY OF BULL TROUT LISTING

Bull Trout and the ESA
A Chronology of Bull Trout Events
June 5, 1998

- October 30, 1992: A petition to list the bull trout as an endangered species throughout its range was received by the U.S. Fish and Wildlife Service (FWS) from the Friends of the Wild Swan, Alliance for the Wild Rockies, and the Swan View Coalition.
- January 7, 1993: A second petition, requesting the listing of bull trout in the Klamath River Basin, was received by the FWS from the Oregon Chapter of the American Fisheries Society.
- May 17, 1993: The FWS published a 90-day petition finding determining that the petitioners had provided substantial information indicating that listing of bull trout may be warranted.
- June 10, 1994: The FWS published a 12-month finding that listing was warranted for bull trout within the coterminous U.S., but precluded by other higher priority work. Due to the lack or unavailability of information, the FWS found that listing bull trout in Alaska and Canada was not warranted.
- November 1, 1994: Two of the petitioners, Friends of the Wild Swan and Alliance for the Wild Rockies, filed a lawsuit challenging the 1994 finding.
- June 12, 1995: The FWS published the recycled 12-month finding concluding that listing was still warranted but precluded.
- June 22, 1995: The Oregon Federal District Court issued an order declaring the 1994 challenge to the original finding moot because the FWS had, by then, issued a 1995 finding. The court instructed the plaintiffs to amend their complaint to challenge the 1995 finding if they so desired. The plaintiffs declined to amend their complaint and appealed to the Ninth Circuit Court of Appeals.
- April 2, 1996: The Ninth Circuit Court of Appeals overturned the District Court and remanded the case back to the District Court for further proceedings, ruling that this type of action was capable of repetition but evades judicial review.
- November 13, 1996: The Oregon Federal District Court granted the plaintiffs' motion for summary judgment, directing the FWS to reconsider the 1994 finding and respond to the court within four months. The ruling included specific direction to consider only the information in the FWS record at the time of the original 1994 finding.

March 13, 1997: In compliance with the District Court order, FWS issued a reconsidered finding based solely on 1994 record, which concluded that two populations of bull trout warranted listing (Klamath River and Columbia River population segments).

March 25, 1997: Plaintiffs petitioned the court to compel the FWS to issue a proposed rule within 30 days to list the Klamath and Columbia River bull trout populations based on the 1994 record.

April 11, 1997: The FWS and the plaintiffs signed an agreement stipulating that within 60 days the FWS will complete a proposed rule to list the Klamath population segment as endangered and the Columbia population segment as threatened.

June 10, 1997: A proposed rule to list the Klamath River bull trout population segment as endangered and the Columbia River population segment as threatened was issued by the FWS.

December 4, 1997 The Oregon Federal District Court ordered FWS to reconsider several aspects of the 1997 finding concerning listing of bull trout. The court directed FWS to: consider whether listing of the bull trout is warranted throughout its range; whether listing is warranted throughout the coterminous U.S.; and if FWS determines that listing throughout its range, or throughout the coterminous U.S. is not warranted, or is warranted but precluded, whether listing of the Coastal/Puget Sound distinct population segment is warranted. The court subsequently directed the FWS to prepare its response by June 12, 1998.

June 1998 The FWS published in the Federal Register a final rule to list the Klamath River and the Columbia River bull trout population segments as threatened under the Endangered Species Act; and a proposed rule to list the Jarbidge River, Coastal-Puget Sound and St. Mary-Belly River populations segments as threatened under the ESA.

APPENDIX 2

OVERVIEW OF NORTHWEST FOREST PLAN

NORTHWEST FOREST PLAN

AN OVERVIEW

INTRODUCTION

The *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl with the Standards and Guidelines for Management of Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (April 1994), hereby referred to as the Northwest Forest Plan, is the result of an unprecedented effort in public land management. The Northwest Forest Plan is a comprehensive ecosystem management strategy for late-successional and old-growth related species on Federal lands managed by the U.S. Department of Agriculture, Forest Service and U.S. Department of the Interior, Bureau of Land Management in Washington, Oregon, and northern California. This strategy was developed and is currently being implemented by the Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, National Park Service, and a numerous other Federal, State, Tribal, and local governments in conjunction with local stakeholders.

The five major Federal laws that apply to Federal land management in the area of the Northwest Forest Plan are the National Environmental Policy Act of 1969, Endangered Species Act of 1973, National Forest Management Act of 1976, Federal Land Management and Policy Act of 1976, and the Oregon and California Lands Act.

BACKGROUND

Over a century of logging in the forests of the Pacific Northwest and northern California has resulted in a highly fragmented mosaic of recent clearcuts, thinned stands, and young plantations interspersed with uncut natural stands. The controversy over the northern spotted owl and old-growth forests in Washington, Oregon, and northern California has been ongoing since the 1970's. The controversy has swirled around management of Federal lands by the Forest Service and the Bureau of Land Management. The result has been described as a gridlock of lawsuits, court rulings, appeals, and protest. The public debate has expanded from a focus on management of northern spotted owl habitat to include management of all old-growth-forest-associated species and old-growth ecosystems.

Since 1991, Federal courts have enjoined the Forest Service and the Bureau of Land Management from holding most timber sales within the range of the northern spotted owl. Courts have held that the agencies failed to meet the various requirements of the National Forest Management Act of 1976, the Endangered Species Act of 1973, and the National Environmental policy Act of 1969. The courts found that:

- Forest Service and Bureau of Land Management failed to take into account the consequences of Bureau of Land Management's plans for protecting northern spotted owls on Bureau of Land Management property (Seattle Audubon Society v. Moseley,

- 1992);
- Forest Service failed to adequately consider the effect of the spotted owl strategy on other species dependent on old-growth forests (Seattle Audubon Society v. Moseley, 1992);
 - Forest Service failed to consider the most recent demographic information on the northern spotted owl (Seattle Audubon Society v. Moseley, 1992);
 - Forest Service failed to develop revised standards and guidelines for management of northern spotted owl habitat in a manner that allowed for public participation and response to the concerns of outside experts (Seattle Audubon Society v. Evans, 1991);
 - Bureau of Land Management failed to adequately consult with the Fish and Wildlife Service regarding its spotted owl conservation strategy (Lane County Audubon Society v. Lujan, 1992); and
 - Bureau of Land Management failed to assess in an environmental impact statement new information on the northern spotted owl (Portland Audubon Society v. Lujan, 1992).

To seek a solution to the controversy, President Clinton held a Forest Conference in Portland, Oregon, on April 2, 1993, to address the human and environmental needs served by the Federal forests of Washington, Oregon, and northern California. The President, Vice-President, and much of the Cabinet spent an entire day listening to all points of view and collecting information. The President then directed his Cabinet to craft a balanced, comprehensive, and long-term policy for the management of over 24 million acres of public land. The President set forth five principles to guide the Federal interagency effort to develop a management strategy to protect the old-growth-related species and produce a sustainable level of timber:

"First, we must never forget the human and the economic dimensions of these problems. Where sound management policies can preserve the health of forest lands, sales should go forward. Where this requirement cannot be met, we need to do our best to offer new economic opportunities for year-round, high-wage, high-skill jobs.

Second, as we craft a plan, we need to protect the long-term health of our forests, our wildlife, and our waterways. They are a gift from God, and we hold them in trust for future generations.

Third, our efforts must be, insofar as we are wise enough to know it, scientifically sound, ecologically credible, and legally responsible.

Fourth, the plan should produce a predictable and sustainable level of timber sales and nontimber resources that will not degrade or destroy the environment.

Fifth, to achieve these goals, we will do our best, as I said, to make the Federal

Government work together and work for you. We may make mistakes, but we will try to end the gridlock within the Federal Government and we will insist on collaboration not confrontation."

President Clinton summed up the Forest Conference:

"We're here to begin a process that will ensure that you will be able to work together in your communities for the good of your businesses, your jobs, and your natural environment. The process we [have begun] will not be easy. Its outcome cannot possibly make everyone happy. Perhaps it won't make anyone completely happy. But the worst thing we can do is nothing."

An interagency, interdisciplinary team of expert scientists, economists, sociologists and others was assembled -- the Forest Ecosystem Management Assessment Team (FEMAT) led by Dr. Jack Ward Thomas (who later became Chief of the Forest Service). After three months of intensive work, which included the review of all fully developed proposals for management of Federal forests within the range of the northern spotted owl, the team produced a report, *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment* ("the FEMAT Report"), assessing in detail ten options. Over 1,000 species associated with late-successional and old-growth forests were evaluated as to the relative efficacy of the various options in providing habitat to maintain their viability on Federal forests.

President Clinton announced his proposed "Forest Plan for a Sustainable Economy and a Sustainable Environment" on July 1, 1993, consisting of strategies for forest management, economic development, and agency coordination. The forest management and implementation portion of the strategy was analyzed in a Draft Supplemental Environmental Impact Statement (Draft SEIS) issued in July 1993, that received over 100,000 public comments during a 3-month, public-comment period. A Final Supplemental Environmental Impact Statement (Final SEIS) was made available to the public in February 1994, selecting Alternative 9 (also known as Option 9). The U.S. Fish and Wildlife Service rendered a biological opinion under the Endangered Species Act on the preferred alternative on February 10, 1994. The biological opinion stated that Alternative 9, the preferred alternative, was not likely to jeopardize the continued existence of any listed species, or result in the adverse modification of any designated critical habitat.

In April 1994, the Record of Decision was issued by the Secretary of Agriculture and the Secretary of the Interior, jointly amending the planning documents of nineteen National Forests and seven Bureau of Land Management Districts. This represents the first time that two of the largest Federal land-management agencies, the Bureau of Land Management and the Forest Service, adopted a common management approach to the lands they administer throughout an entire ecological region.

OVERVIEW

The Northwest Forest Plan management direction consists of extensive standards and guidelines, including land allocations, that comprise a comprehensive ecosystem-management strategy. The

strategy is based on Alternative 9 of the Final SEIS, except for minor modifications noted in the Record of Decision or made in the attached standards and guidelines. The conservation measures included in the strategy are based upon the best available science and attempt to anticipate and forestall future environmental problems, avoiding severe economic dislocation and legal gridlock that occur when environmental problems are ignored.

There are more than 24 million acres of Federal land in the planning area, defined as the range of the northern spotted owl. Approximately 30% of these acres have been set aside by act of Congress. The remaining 70% were allocated by the Northwest Forest Plan direction as: late-successional reserves (30%); adaptive management areas (6%); managed late-successional areas (1%); administratively withdrawn areas (6%); riparian reserves (11%); and matrix (16%). Standards and guidelines for each land allocation provide a coordinated ecosystem-management approach to the planning area. Although certain thinning and salvage activities are allowed in the reserves, programmed timber harvest is only to occur in the 22% of the land designated as matrix or adaptive management areas, and only in compliance with standards and guidelines designed to achieve conservation objectives.

There is considerable overlap among some designated areas. For clarity, acreage of these lands subject to such overlaps are reflected in only one category, according to the order of land allocations in the following descriptions.

Congressionally Reserved Areas comprise 7,320,600 acres, representing 30% of the Federal land within the range of the northern spotted owl. These lands have been reserved by act of Congress for specific land-allocation purposes. This decision cannot and does not alter any of these congressionally mandated land allocations. Included in this category are National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges, Department of Defense lands, and other lands with congressional designations.

Late Successional Reserves comprise 7,430,800 acres, representing 30% of the Federal land within the range of the northern spotted owl. These reserves, in combination with the other allocations and standards and guidelines, will maintain a functional, interactive, late-successional and old-growth forest ecosystem. They are designed to serve as habitat for late-successional and old-growth related species including the northern spotted owl.

Late-successional reserves are to be managed to protect and enhance old-growth forest conditions. For each late-successional reserve (or group of small reserves) managers are to prepare an assessment of existing conditions and appropriate activities. No programmed timber harvest is allowed inside the reserves. However, thinning or other silvicultural treatments inside these reserves may occur in stands up to 80 years of age if the treatments are beneficial to the creation and maintenance of late-successional forest conditions. In the reserves east of the Cascades and in Oregon and California Klamath Provinces, additional management activities are allowed to reduce risks of large-scale disturbance. Salvage guidelines are intended to prevent negative effects on late-successional habitat. Non-silvicultural activities within late-successional reserves are allowed where such activities are neutral or beneficial to the creation and

maintenance of late-successional habitat. Thinning or other silvicultural activities must be reviewed by the Regional Ecosystem Office and the Regional Interagency Executive Committee.

Adaptive Management Areas (AMAs) comprise 1,521,800 acres, representing 6% of the Federal land within the range of the northern spotted owl. These areas are designed to develop and test new management approaches to integrate and achieve ecological, economic, and other social and community objectives. The Forest Service and Bureau of Land Management will work with other organizations, government entities, and private landowners in accomplishing those objectives. Each area has a different emphasis to its prescription, such as maximizing the amount of late-successional forests, improving riparian conditions through silvicultural treatments, and maintaining a predictable flow of harvestable timber and other forest products. A portion of the timber harvest will come from this land. There are ten adaptive management areas.

Managed Late Successional Areas currently comprise 102,200 acres, representing 1% of the Federal land within the range of the northern spotted owl. These lands are similar to Late-Successional Reserves but are either (1) mapped managed-pair areas or (2) unmapped protection buffers, primarily east of the Cascade Crest where regular and frequent fire is a natural part of the ecosystem. Managed-pair areas are delineated for known northern spotted owl activity centers. Protection buffers are designed to protect certain rare and locally endemic species.

Administratively Withdrawn Areas comprise 1,477,100 acres, representing 6% of the Federal lands within the range of the northern spotted owl. Administratively withdrawn areas are identified in current forest and district plans or draft plan preferred alternatives and include recreational and visual areas, back country, and other areas not scheduled for timber harvest.

Riparian Reserves initially comprise 2,627,500 acres, representing 11% of the Federal lands within the range of the northern spotted owl (acreage subject to change following watershed analysis). The calculation of riparian-reserve acreage is done after all other designated areas. As a result, the acreage shown reflects only that portion of riparian reserves that is interspersed throughout the matrix. Riparian reserves are areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. The main purpose of the reserves is to protect the health of the aquatic system and its dependent species; the reserves also provide incidental benefits to upland species. These reserves will help maintain and restore riparian structures and functions, benefit fish and riparian-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat.

Matrix comprises 3,975,300 acres, representing 16% of the Federal land within the range of the northern spotted owl. The matrix is the Federal land outside the six categories of designated areas set forth above. It is also the area in which most timber harvest and other silvicultural activities will be conducted. However, the matrix does contain non-forested areas as well as

forested areas that may be technically unsuited for timber production. Standards and guidelines ensure appropriate conservation of ecosystems as well as provide habitat for rare and lesser-known species. Some of the major standards and guidelines for matrix lands are:

- a renewable supply of large down logs must be in place;
- at least 15 percent of the green trees on each regeneration harvest unit located on National Forest land must be retained (except within the Oregon Coast Range and Olympic Peninsula provinces); and
- 100 acres of late-successional habitat around owl activity centers that were known as of January 1, 1994, must be protected.

The following briefly describes some of the significant standards and guidelines, not previously identified above:

Aquatic Conservation Strategy: The aquatic conservation strategy contains four components: riparian reserves; key watersheds; watershed analysis; and watershed restoration. Each part is expected to play an important role in improving the health of the region's aquatic ecosystems.

1. **Riparian Reserves:** The aquatic conservation strategy designated initial reserve widths for protected riparian areas, as well as specific requirements for timber management, road construction and maintenance, grazing, recreation, minerals management, fire/fuels management, research, and restoration activities. Initial boundary widths for riparian reserves are as follows:
 - Fish-bearing streams - the area on each side of the stream equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greater;
 - Permanently flowing nonfish-bearing streams - the area on each side of the stream equal to the height of one site-potential tree, or 150 feet slope distance, whichever is greater;
 - Lakes and natural ponds - the body of water and the area to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greater;
 - Constructed ponds and reservoirs and wetlands greater than one acre - the area from the edge of the wetland or the maximum pool elevation to a distance equal to the height of one site-potential tree, or 150 feet slope distance, whichever is greater;
 - Seasonally flowing or intermittent streams -- the area on each side of the stream to a distance equal to the height of one site-potential tree or 100

feet slope distance, whichever is greater;

- Wetlands less than one acre and unstable and potentially unstable areas - the extent of unstable and potentially unstable areas, and wetlands less than one acre to the outer edges of the riparian vegetation.

Riparian reserve initial boundary widths established by this decision will remain in effect until they are modified following watershed analysis. Guidance on boundary modifications are contained in the Record of Decision standards and guidelines.

2. Key Watersheds: The Aquatic Conservation Strategy designated three categories of watersheds:

- Tier 1 key watersheds -- those to be managed for at-risk anadromous salmonids, bull trout, and resident fish (141 watersheds, 8,119,400 acres);
- Tier 2 key watersheds -- those where high water quality is important (23 watersheds, 1,001,700 acres); and
- Non-key watersheds -- all other watersheds (15,334,200 acres).

3. Watershed Analysis: Watershed analysis is a systematic procedure to characterize the aquatic, riparian, and terrestrial features within a watershed. Managers will use information gathered during watershed analyses to refine riparian-reserve boundaries, prescribe land-management activities including watershed restoration, and develop monitoring programs.

4. Watershed Restoration: Watershed restoration is designed to restore currently degraded habitat conditions. The most important components are control and restoration of road-related runoff and sediment production, restoration of riparian vegetation, and restoration of in-stream habitat complexity. Restoration programs will initially focus on arresting road-related erosion and silvicultural treatments in riparian reserves to restore large conifer canopies. In-stream restoration is inherently short-term and will be accompanied by upslope and riparian restoration to achieve long-term watershed restoration.

Survey and Manage Strategy: The standards and guidelines require land managers to take certain actions relative to rare species of plants and animals, particularly amphibians, bryophytes, lichens, mollusks, vascular plants, fungi, and arthropods. These include: (1) manage known sites of rare organisms; (2) survey for the presence of rare organisms prior to ground-disturbing activities; (3) conduct surveys to identify locations and habitats of rare species; and (4) conduct general regional surveys for rare species.

For many species and taxonomic groups, adequate survey techniques may not exist. The standards and guidelines provide an implementation strategy that includes a time line for developing protocols for the surveys and conducting the necessary survey work.

In order to coordinate the activities of the numerous involved Federal agencies, an interagency structure was established that includes the Regional Interagency Executive Committee, the Regional Ecosystem Office, and provincial teams. These groups oversee and direct the implementation of the Northwest Forest Plan. In order to facilitate implementation, interagency regional workgroups are chartered by the Regional Ecosystem Office to develop implementation guidance on numerous aspects of the Northwest Forest Plan, such as watershed analysis, watershed restoration, and Late-successional Reserve analysis.